PSYCHOLOGY

HIGHER SECONDARY-FIRST YEAR

TAMILNADU TEXTBOOK SOCIETY

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CONTENTS

CHAPTER-I

AIM, SCOPE AND METHODS OF PSYCHOLOGY

Introduction

Human beings are always very curious to know about the behaviour of others and also about their own. There are several social sciences that deal with human behaviour in one way or other at one stage. But the dealings of those sciences will not help them to fulfil their curiosities fully. For example, anthropology deals with the antiquities of men, sociology deals with the group life, history studies the life stories of dead kings and queens, economics is interested in the production, distribution and consumption of goods. The studies of these sciences are dealing with one of the aspects of human life and not full. Similarly psychology is also interested in the study of human behaviour. But of all the social and biological sciences, psychology is the only science that tries to study man from all the dimensions. For this purpose it combines several sciences into its fold and makes its study very intensive and extensive.

Psychology has acquired additional and valuable informations about the external physical world through physical sciences like physics, astronomy and chemistry and internal physiological and emotional world through physiology and medicine and also through social sciences like anthropology, sociology, history and economics for its use. Psychology hopes that it could approach the mysterious human behaviour with these additional informations and find out solution for the problems. Therefore, psychology is the only science which has synthasised the informations of the external and internal worlds for its study.

Definitions

To define psychology in precise terms is a difficult task as the word psychology is having a long history and is also

combined with other faculties like religion and philosophy. Further psychology is defined in a variety of ways. Psychologists, for very long time have been searching for a complete and satisfactory definition of psychology. It seems that the search is still going on.

Originally, psychology may be defined as the science of the soul. The word psychology is derived from the Greek words 'Psyche' and 'logy'. Psyche means soul or spirit. Logy means science or department of knowledge or character or action of a person. Therefore, combining these two Greek root words, the Oxford English Dictionary defined psychology as the science of nature, functions and phenomena of the human soul or mind.

In Greek mythology 'Psyche' is personified as the beloved of Eros (Cupid), the god of love and represented as the beautiful maiden having the wings of a butterfly. Psyche symbolized the soul, and the butterfly symbolized the human immortality. The soul is regarded as an entity distinct from the body. It is the spiritual part of man. It is spoken of after the death of man. It is purely a religious explanation and does not fit into the scientific study of human behaviour. Therefore, the religious associations have to be dropped out completely. At this stage the word psyche has acquired the meaning of mind.

Psychology is defined as the science of the mind. William James says, "Psychology is the science of mental life ....". The term mind is defined in a variety of ways. In the olden days it was referred to as remembrance, in the middle ages it was referred to as the faculty of memory. But, mind was generally defined as the seat of consciousness or thought. This definition is not clear. It could not receive the general acceptance from all the psychologists. Further, the term and definition seem to have certain philosophical implications. Therefore, the psychologists who are interested in the scientific study of human behaviour are not ready to accept a philosophical meaning. So long as psychology was considered as the part of philosophy, there was no disagreement with regard to these kind of definitions.

The emergence of behaviouristic movement made radical changes in the definitions and in the method of study. Modern

psychology cut off its all associations with philosophy and it has become an independent faculty. It has its own terminology, meaning, definition and interpretation. Therefore, psychology tries to explain its subject matter from scientific point of view. Watson, the founder of the school of behaviourism has objected to any reference to mental processes in the scientific study of psychology. He strongly felt that psychology studies behaviour and not thoughts or ideas or any other subjective events Contemporary psychologists defined psychology as the science of behaviour. Science studies its subject matter objectively. Psychology too tries to study its subject matter objectively. It studies only that which can be observed. It does not deal with unscientific matters like soul or mind which no one can see, touch or examine.

Psychology may be defined as the science that studies human behaviour systematically. Why is psychology the study of behaviour ? Why not mind or thought ? The answer is straight forward. You can study only what you can observe and behaviour is the only aspect of a person that is observable. Kendler defines behaviour as the observable responses of the organism. There are events going on within a person – events that can be called thoughts, feelings and mental activities. We can make inferences about these events, but we always make the inferences from the way a person behaves or acts. It is what the person does, writes, says that we can observe and record as the scientists do. Hence it is only behaviour that we can study.

Behaviour is revealed in various kinds of activities. Therefore, psychology may be also defined as the science of activities of the individual. It is greatly interested in the general law of activity. The term activity is used in a broader sense. It includes cognitive activities like seeing, hearing, remembering and thinking, motor activities like walking and speaking and emotional activities like laughing, weeping and feeling happy or sad.

What is an activity ? An activity is the manifestation of life. Human life is revealed in various ways. An event of life may be called an activity. Every living creature is involved

in some kind of activity. For example, watching a game, listening to a radio, music or television programme, smelling a flower, tasting a sweet meat, touching a smooth surface may also be called an activity. An organism or a human being becomes inactive only after his death. Human activity is looked upon by psychology from different angles. But there are also other sciences that study human activities from different angles. Therefore, this requires some clarification.

Ordinarily, we say that psychology is concerned with activities such as learning, remembering, thinking, planning, observing, wishing, loving, hating, walking, eating etc. These are generally grouped under three main headings of knowing, feeling and doing. But any mental activity can be called at the same time a bodily activity. In any bodily activity in which the mind is active, the muscles and sense organs also play an important part. It is the province of physiology to discover how the various organs operate. Physiology analysis the organs to pieces and thus sees what each organ contributes to life. It tries to find out what goes on in the ear while we are listening to a music programme, what goes on in the eyes while looking at an object and what goes on in the speech organs during talking. It tries to see how the muscles work in every part of the body It further examines how the complicated organ—the brain integrates the activities of the individual and makes him to deal with the complicated environment.

But, if the activities of the individual can be analysed into the activities of his organs why should we study the individual as a whole? The answer is, that physiology studies only a part of what we need for our purpose. The individual is a real and whole unit. It is the individual who loves and hates, acts and rests. He has many tasks to perform and problems to solve in his life. He deals with other persons and things happily or sorrowfully. Therefore, there is a vast amount of interaction between the individual as a whole and the world around him. That is why psychology studies the individual's activities in relation to the environment. A newspaper, for example, may contain many informations about a cricket match, but the reader may not get the information that he wanted. He may be

interested in seeing the photographs of a particular player, which may be missing in the information. We can get physiological, psychological and sociological pictures of a human activity. Each one may present a valuable information. In this way, psychology is interested in the individual's activities in relation to the environment

Scope of Psychology

Psychology studies the activities of the individual throughout his span of life. It studies his life before birth, up through infancy, child-hood and adolescence to maturity and through his declining year. Psychology compares the child and adult, normal and abnormal and human and animal. It is interested in studying the differences between one individual and another. It is greatly interested in the general law of activity such as learning, remembering, thinking, problem solving, imagination, emotion and motivation. Every psychological process may become a specialised area. In this way the subject matter of psychology is enlarged into several main and sub areas. Each area is interested in one aspect of human behaviour. Its scope has grown so vast that no single individual can specialise in all the areas. Therefore, there are specialists in every area who have mastered it. After the world war II, the areas of professional psychology have grown very rapidly. An elaborate description of all the areas cannot be done here. Let us describe ome of the major areas like developmental psychology, Social psychology, psychology of personality, Clinical and counselling psychology, Physiological psychology, Psychometry and Community Psychology.

1. Developmental Psychology : Developmental Psychology is mainly concerned with the behavioural changes at different levels of development. These changes accompany the growth and development of the body of the organism. It is also interested in the factors that shape the human behaviour from the time of birth to old age. Developmental psychology studies the behaviour of the infant, its mental development, physical development, motor development, speech development, emotional development, social development, its relation to religious activities, development of aesthetic sense, its play, interests and personality development.

Developmental psychology is greatly interested in the types of relationship the child has developed towards its parents, siblings, teachers, schoolmates, playmates and strangers. It shows more concerns in the child-hood problems and mental health problems. Developmental psychology studies these aspects of the individual from infancy to old age. It is mainly divided into child psychology and the psychology of adolescence. It is a very vastly developed area that it has both the research and applied areas. The applied area at present mainly concentrates on disturbed children or the dis-advantaged children.

2. *Social Psychology*: The development of the individual is taking place in the midst of other human beings such as parents, siblings, schoolmates, playmates and teachers. Therefore, a large part of human development is social in nature. Social psychology is interested how the individual's interaction with the group influences the behaviour of other individuals and the group and how he is influenced by the group.

Social psychology is mainly concerned with individual's behaviour in the group or society. It studies how the individual is influenced by the structure and function of the society in which he is a member. The individual acts according to the customs, manners and stereotypes of his group. Social psychology is interested in various social phenomena like formation of public opinions, attitudes and interests and how they are changed. It shows more interest in the measurement of opinion and attitudes, the effects of propaganda, market research and mass media of communication like newspaper, motion pictures, radio and television. The subject matter of social psychology includes riots, revolution, wars, the effects of segregation and racial and communal prejudices.

3. *Psychology of personality* : This area of psychology is primarily interested in the individual case. It studies individual's personality characteristics. The individual's personality develops in relation to mental, physical, social and emotional developments. Personality development is greatly influenced by the physical and social factors. Drugs, medicines,

vitamins, minerals, acids and social situations are said to have influence upon the personality development.

Personality psychologists have developed refined methods to study and measure personality traits of an individual. Large number of personality and interest inventories have been used by them to assess the individual's personality. With the help of these instruments they are able to classify human beings into different types of personality. Personality psychologists show interest not only in the study of normal persons, but also in the abnormal. They have evolved several theories with which they can explain the individual's behaviour.

4. *Physiological Psychology :* Physiological psychology is not an independent science. It has become a distinct field of study in psychology as its subject matter is at the frontier of some of the biological sciences. However when one is a trained expert in any one of these sciences he cannot work effectively in physiological psychology. Relevant data from psychology, physiology, anatomy, pharmacology, neurophysiology and chemistry have to be collected and integrated to constitute physiological psychology. Therefore it is a combination of several sciences.

Physiological psychology studies in detail the parts and the functions of the brain and nervous system, the nature and characteristics of the sense organs, the functions of the glandular system and all those things that are closely related to our mental life. Physiological psychologists are of the view that the first step in understanding the human behaviour is to understand how the external world come to be a part of the mind. They stress the point that a man can learn only by what he perceives and what he perceives is only by means of his sensory apparatus. All knowledge and behaviour come about only by perceiving the external world through the senses like vision, audition, taste, smell, touch and kinesthesis. Therefore, the important subject matter of physiological psychology is the physiological and chemical processes and their anatomical bases that come in between the arrival of sensory signals in the central nervous system and the appropriate responses to them.

5. *Psychometry :* Psychometry is one of the areas of psychology which is mainly interested in the measurement of

qualities or properties of objects or persons. It is interested in the measurement of duration and intensity of mental states or processes. It is the application of mathematics and measurement to psychology in general and mental testing and analysis of experimental results in particular. The psychometrician is interested in developing tests and methods to measure sensory and mental abilities of human beings. Psychometry provides tools and test materials to applied areas like Industrial Psychology, Vocational Psychology, Clinical and Counselling areas. Psychometry is a modified area of experimental psychology.

6. *Clinical and Counselling Psychology* : Clinical Psychology is the area of psychology that studies the psychological problems. It studies the causes of the problems, and applies the psychological principles to diagnose and to treat them. It mainly deals with the emotional and behavioural problems such as all kinds of mental illness, criminal behaviour, alcoholism, mental retardation, juvenile delinquency, marital conflict and other adjustment problems.

According to Cate's study, there are about twenty nine percent of the psychologists engaged in the field of clinical psychology. Clinical psychologists work in hospitals, juveniel court, probation office, prisons, community centres, and in schools. He may even do private practices. But he must have close contact with psychiatrists. The clinical psychologist's activity may range from administering personality and adjustment inventories to individual and group therapy and finding out the effectiveness of various therapies.

The work of a psychologist who is engaged in counselling and guidance is not completely different from that of a clinical psychologist. He too works with individuals having mild problems. The counselling psychologist's work is mainly with students in High schools and colleges. He deals with individuals who need expert guidance for their emotional and social problems. He guides the students to find out their correct educational and vocational goals.

7. *Community Psychology* : One of the most revolutionary developments that took place very recently in Psychology is the

emergence of community psychology. It is evolved from the field of mental health. The community is considered as the casuative factor of behavioural and social problems and also as the potential agent for solving the problems. Community psychology is a new approach to deal with human problems. It is considered as one of the therapies used for human problems. It emphasises that the role played by the environment is the cause of all adjustment problems and therefore, the environmental forces must be handled in such a way that the human problems are solved.

Community psychology stresses that the mental health workers should become very active and approach the problems by themselves rather than waiting that the problems should come to them. Community psychology is based on the idea that psychological problems occur only in the society. People live in the families and communities. They are taught to behave in certain ways and they expect certain things from others. Therefore, crisis in the families and in the societies such as emotional and social frustration, economic frustration, poverty, loss of family members, broken homes, mobility, divorce and social changes all contribute to psychological problems. Therefore, the aim of community psychology is to set up methods to study human behaviour as it occurs at homes, on the street, in the societies, in the work places and to study the complex relationships between the people and their physical environments.

The goals of community psychology are to prevent mental illness and to educate the public who have limited access to treatment. One important work the psychologist does is that he makes the people of different categories to recognise the signs of psychological crises. In short, he educates the public in two ways. The first is that he informs people that there is help for emotional problems and guides them. The second is that he teaches them how to cope with the problems.

In the United States, there are community mental health centres which provide emergency psychological aids for the people who have problems. There are more than 400 Community mental health centres in U. S. A. providing various kinds of services. They provide people with

three kinds of services. (1) They treat emotionally maladjusted individuals before they reach a serious stage. (2) They provide a short-term hospitalization when it is required. (3) They make arrangements for receiving treatment at the health centre and go home after a short stay. The community mental health movement also tries to reduce tensions in the community that may lead to social maladjustments In this way the mental health workers try to change the harmful attitude of the community and establish harmonious situation in the society.

Methods of Psychology

Psychology is defined as the science of behaviour. Therefore, psychologists believe that they can study behaviour of an organism in the same manner as the physical and biological scientists study their subject matter. Physical and biological sciences base their studies mainly on experiments, though some sciences depend upon objective observations. Modern psychology meets with many difficulties from its experimental point of view. If psychologists wanted to use the methods of science, psychology also must possess all those qualities possessed by other sciences. The aim of psychology is to give us new and useful informations. These informations first of all must be obtained empirically. They must be verifiable. Those who are interested in the same study can also make similar observations and obtain the results. These results must be presented quantitatively.

Secondly, a science is systematic. In scientific studies observations and experimentations themselves do not make meaning. The data must be presented meaningfully. This is done according to certain principles and laws. This process we may call as the system of classification. The biological scientists often classify their subject matter systematically.

Thirdly, science is measurable. In every science some kind of measurement is made and the data is presented precisely and accurately. Physics is the science that could present its data more precisely and accurately than all other sciences. But the accuracy of measurement depends upon the nature of science.

Empirical, systematic and measurable are the three important characteristics of a science. Psychologists believe that

psychology also possesses all these characteristics and therefore, they also can aim at the same goals as the scientists do. Towards the achievement of their goals they have developed certain scientific methods and techniques. We shall now describe some important methods of psychology.

1. Introspective method: Introspective method is one of the oldest methods of psychology. Introspection means looking within. It is the action of looking within one's own mind. It is the examination or observation of ones own thoughts, feelings and actions. In the beginning of psychological study introspection is the main source of getting informations about the mind. It is assumed that human beings can have access to mental activities and can observe the facts systematically, collect and interpret. Human beings can introspect into their various sensations, feelings, elementary motives and cognitive processes.

It was Wilhelm Wundt who founded this method as one of the approaches to psychology. For him, introspection is a method of research tbat requires subjects to observe and report upon the experiences of their own. In the early days introspectionism revealed the idea that mind and consciousness are the same. It is believed that subjects are able to know and describe their own thoughts. But later on the weeknesses of this method was revealed. In the study of personality, motivation and emotion introspective method had its own limitatio ns.

(1) One of the weaknesses of this method is that it is not possible for another person to observe and verify whether the informations revealed by this method is correct or not. (2) Certain aspects of human behaviour cannot be introspected. For example, our emotions and motives. The moment we start introspecting the emotions like rage and fear they fade away in their intensities and change their nature. (3) We cannot use this method on children and animals as they are incapable of introspection and reporting their experiences. (4) This method is subjective in nature and private to the observer. We will have to depend upon his statements for everything. Therefore, it is not an objective and scientific method. Modern psychologists reject this method on these grounds. But the method with all its limitations and weaknesses is still used in some of the important psychological researches.

2. *Experimental method :* The experimental method has been mainly responsible for the great advancement of the world of natural sciences. This method can be used both inside and outside the laboratory. An experiment may be defined as an attempt to discover the relationships that exist between two variables or among a number of variables. It is also defined in another way. An experiment is a controlled condition in which an independent variable is manipulated and the corresponding changes in a dependent variable are measured. A variable is any aspect of a person, event, environment or object that can be changed or held constant in an experiment and can be measured. But experimenting on human nature is a more complicated task than experimenting on matters, hydrogen or frogs. A human being is affected by many kinds of influences whereas matters and animals are not.

The experimental method is a procedure of explaining the data that were directly observed and collected in an experiment conducted in a laboratory situation. An experiment is something which can be repeated in the same situation. An important characteristic of a laboratory is that it is a place where variables can be controlled by the experimenter, measurements can be taken and relationships between variables can be discovered. Any one with proper equipment can demonstrate that water is made up of oxygen and hydrogen in chemistry. In psychology the subject matter is man himself. Therefore, two groups of men must be brought into the laboratory.

In every experiment we must have two variables, one independent and one dependent. Suppose, we are interested in finding out whether certain condition improved our ability to learn some material. To test this we must have two groups of subjects, one experimental group and the other control group. Both groups must be as identical as possible in all respects. The condition that would improve the learning ability may be the effect of a tranquilizing drug. Therefore, this drug is given to the experimental group before learning takes place. The drug is not given to the control group. Now both the groups are given the same material to learn. The experimental group learns under experimental conditions and the control group learns under normal conditions. The average scores of the two

groups in learning the material under the two conditions are compared. Whether the experimental condition is having more effect on learning than the normal condition or not is determined.

In physiological psychology in studying sensory and motor functions laboratory experiments often involve elaborate and sensitive apparatus. This method possesses all the characteristics of a scientific method. But psychological experiments must be conducted with all seriousness. Otherwise we would be collecting only wrong informations. Therefore, we cannot neglect the possible errors occuring in psychological experiments.

3. *Objective observation :* The method of objective observation is also called naturalistic observation. This method is concerned with systematic investigation of phenomena which occur without any effort or arrangements on the part of the investigator himself. Some of the biological and astronomical or physical events require naturalistic observation just as they occur since they cannot be brought into the laboratory situation. In the same manner some of the psychological phenomena are studied by this method.

In the fields of developmental psychology, social psychology, industrial psychology, particularly this method would be of very much useful to the investigators. In the determination of average age at which walking begins in small children, in the study of various stages of speech development and in other developmental processes this method may be of great help.

Further, public opinion, the effects of propaganda, animal behaviour, the nesting habits of birds may be also studied by this method. This method is used as a substitute to anecdotel method. The faults in observation and the errors due to biases can be reduced in this method. The observer can be trained well to record the events and conditions to make the study more accurate. One difficulty with the method is that the observer has no chance of influencing the event observed by manipulating the independent variable like the experimental method. The observer simply makes systematic study of the conditions and events as he observes them. The difficulties that

arise from the introspective method can be avoided here. One limitation of this method is that it is not possible to observe the inner motives and the emotional aspects of the individual. We will have to depend upon only the outward expressions of the organism.

4. *Case history method :* This is one of the methods used in early days of psychological studies. Case history means a biography of a person obtained for scientific purposes. The material for this kind of study is obtained over several years and sometimes by the method of interviews. When the biographical data is obtained scientifically it is called case history. This becomes an important source of information for the psychologists to study individuals. The psychologists have to study different types of persons. He has before him a genius, a criminal, a maladjusted worker, a problem child or a fine personality. He believes that he can find out the causes of the maladjustments and adjustments by studying the antecedents of a specific form of behaviour. The case history method usually has three basic forms such as (a) day-book method (b) the clinical method and (c) the biographical method.

(*a*) *The day-book method :* This method is most often used in the developmental psychology, particularly to study the child's behaviour. The child's various developmental processes are very carefully observed and recorded in a standard manner. Such records will include the age at which the child makes his first smiles, sits crawls, stands, walks, recognition of siblings and strangers and so on. This kind of facts become the accumulated records. They provide us with standard informations to judge the development of other children.

(*b*) *The clinical method :* This method is used to study an individual when he is handicapped in some form. In psychological study the handicaps may include some form of personal or social maladjustments or some kind of deficiency such as mental deficiency or a severe reading disability. This method may be in the form of verbal interviews with the subject. This was first used by the doctors. When a person goes to him with certain problems he uses this method. On the basis of the nformations collected from the interviewers, past life history,

and other informations collected from various sources the observer may prepare a case history of the individual. The life history of a person is reconstructed. In this way the clinical method represents on elaborate and extensive records of the day-book method. This reconstructed records – the case history may be useful for clinical diagnosis and for systematic treatment. The clinician through proper training could make very accurate reports.

An effective clinical study requires the help of three professional workers such as the psychiatrist, the psychologist and the social worker. The psychiatrist or the physician examines the individual's physical and mental illness. The psychologist evaluates his mental abilities and personality characteristics. The social worker examines the home conditions and the social backgrounds. A good psychological clinic provides for a follow-up to see that the recommendations are observed and report the progress shown. This method is used on children and adults. The clinical method is important in two ways. It provides us with informations concerning the adjustment problems of human beings. Secondly it attempts to modify behaviour in the interest of personal and social welfare.

(c) *The biographical method :* This is an attempt by which we can obtain certain psychological knowledge about the individuals. An understanding about the individuals is obtained from an analysis of the records of the lives of men as set down by themselves or by others. Thorndike made an elaborate study by using this method. He made personality analysis of 92 famous men on the basis of their biographical informations He rated each man in terms of 48 different personal characteristics such as intelligence, sensitiveness, sociability, agreeableness, liking for beauty and so on. He can understand from this study the characteristics which underlie the achievement of greatness in various fields.

5. *Interview method :* If we wish to know something about a person, one method to do so is to ask him questions and to evaluate his answers. This kind of enquiry is called interview. It may be structured, controlled and standardised with respect to the questions asked. Psychologists and resear-

chers in other fields believe that interviews can be used to study the personal inner life of the individual and would yield knowledge that can be used for the prediction of behaviour. The behavioural sciences started out with this intention and this was dominent in nineteenth century psychological studies.

What is an interview? An interview is a conversation with a definite purpose. There are four purposes in the interview. (1) Obtaining information from the interviewee. (2) Providing information to the interviewee. (3) Finding out the motivation of the interviewee. (4) Assessing behaviour under standardised conditions. An interview may also be defined as the purposeful conversation and a face-to-face relationship between two people. There are many definitions of an interview. But all definitions include these aspects.

Interviewing is a special kind of technique that requires a special knack or training to deal with the interviewees successfully. Interviewers can be trained to adapt the method in such a way that the interviewee may feel at ease to give truthful responses. Within a short time the interviewer has an opportunity to observe some of the aspects of the person's behaviour. The person's way of looking at the interviewer, manner of speech, facial expressions when he answers well and when he fails to answer, tendency to avoid and accept certain things and so on. The interviewer should provide the interviewee with more chances to speak and express his personal experiences, feelings, interests and attitudes. He must establish rapport in such a way that the interviewee speaks out all that he has in his mind.

There are two broad types of interviews. They are structured interviews and unstructured interviews. In structured interviews the interviewer uses standardised questions in a predetermined manner He may use either a checklist of some general topics or a list of short questions. These questions are in printed form supplied to the interviewer at the time of interview. The structured interview method has certain advantages. If the questions are not patterned the interviewer may forget or omit certain important aspects of the study or enquiry. There is definite answer for every question in this

method. It is possible to compare the interviews conducted by several other interviewers with this kind of information. This method is mainly used in the employment situations–particularly in selection and placement.

The structured interview is also called patterned interview or standardised interview. This was designed by McMurray to measure the personality traits that are wanted for employees.

In the unstructured interview method the interviewer has no definite plan as to the questions. He is at the liberty of asking any question that he finds suitable to the situation. During the course of conversation he may find certain strategic moments. He may ask certain specific questions at this moment. The interviewer makes over all evaluation of the interviewee and develops certain general opinion. The clinical psychologists are the chief advocates of this method of interview. They allow the conversation to wander freely. They say that the causes of the particular type of behaviour vary from person to person. Therefore, questions that are suitable for probing one person are not suitable to another.

The interview method may be used in three important situations. They are (1) personal counselling situation, (2) measurement of personality, (3) vocational guidance situation. In all these situations the individual's various aspects of behaviour are studied and predicted. The chief advantage of this method is that abilities and traits cannot be accurately measured by tests and therefore, interviews must be substituted to paper-pencil tests. On the positive side we see whether the candidate is good looking or not and how he reacts to conversation. One important disadvantage of the interview method is this. The interviewer cannot judge a man's personality and character traits such as honesty, loyalty etc., from his face. A shifty gaze need not be mistaken for dishonesty. Conduct and character do not agree with contours of the face.

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CHAPTER II

HEREDITY AND ENVIRONMENT

Introduction

A class room may consist of several students. They may range from twenty to one hundred. Look at them all very carefully. They do not look alike. Each one differs from the other in one way or other. All of them may be of the same age, may come from the same home town, live in the same hostel, eat the same type of food and sleep for the same number of hours. Physically they are not equal. Few may be very tall, few may be very short and most of them may of moderate height. When arithmatic exercises are given to them some of them do the exercises excellently, some do with some difficulty and few do not understand them. When they go to play grounds, few master all the games, some do only some games, some afraid of going near the pit for jumping and some do everything with pleasure. Thus students may differ from each other physically, mentally and emotionally. Why these differences in the individuals? Are there not any causes behind all these differences? It is impossible to give complete and perfect answer for all these questions. Many causes have been attributed for these differences.

Scientists believe that the differences are due to biological foundations. Every individual is having different biological foundation. Therefore, if we want to know more about the biological foundation, we must know something about the influence of heredity.

Genetics

The branch of biological science that studies the hereditary characteristics and the transmission of the characteristics is called Genetics. According to genetical studies traits are passed from one generation to the next in people, plants and in animals.

We often hear the words: "heredity runs in our family". We all have inherited certain traits from our parents, grand parents and ancestors. Gregor Mundel, a Moravian monk, who founded the modern genetics believed that every trait was controlled by some inner elements which were transmitted without any change from one generation to the next. These elements were genes. We often say that the genes are the careers of heredity. During the course of fertilisation, the genes are separated and recombined in the ovum. Thus the child inherits one trait from father and one from mother. The inherited traits may be both similarities and differences. Human behaviour depends upon heredity and environment. The inherited traits may be changed due to different interactions of the environmental factors.

Mechanism of heredity.

Every organism, whether human, animal or a plant begins its life as a single cell. Human life begins as a single cell in a fertilized ovum. The male cell is called sperm cell and the female cell is called ovum or egg cell. The sperm cell of the male penetrates into the egg cell of the female during sexual intercourse and fertilizes it. The fertilized ovum or egg cell is called zygote. The fertilized ovum grows and divides into two cells. These two divides into four, four into eight, eight into sixteen and so on. They multiply into millions. The cell divisions become various parts of the organism. Some become nerve cells, some muscle cells and some gland cells.

Chromosomes : Every normal human cell contains a nucleus which is surrounded by cytoplasm. In the nucleus there are little thread-like bodies called chromosomes. This can be seen under microscope. There are 46 chromosomes in the nucleus of the cell. They are always found in pairs and there are 23 pairs of chromosomes. They vary in size and shape. Some of them are large, some shorter, some with curves and some straight.. The number of chromosomes vary in animals, birds and plants. But the same number of pairs are found in every species. During the course of fertilization the 23 pairs of chromosomes from male's sperm and the 23 pairs of chromosomes from female's ovum are combined into a single cell called zygote. They do

not make into 46 pairs. When the reproductive cells called gametes are formed the chromosomes from sperm or ovum do not divide. Therefore, there are only 46 chromosomes, 23 chromosomes from sperm cell and 23 from ovum.

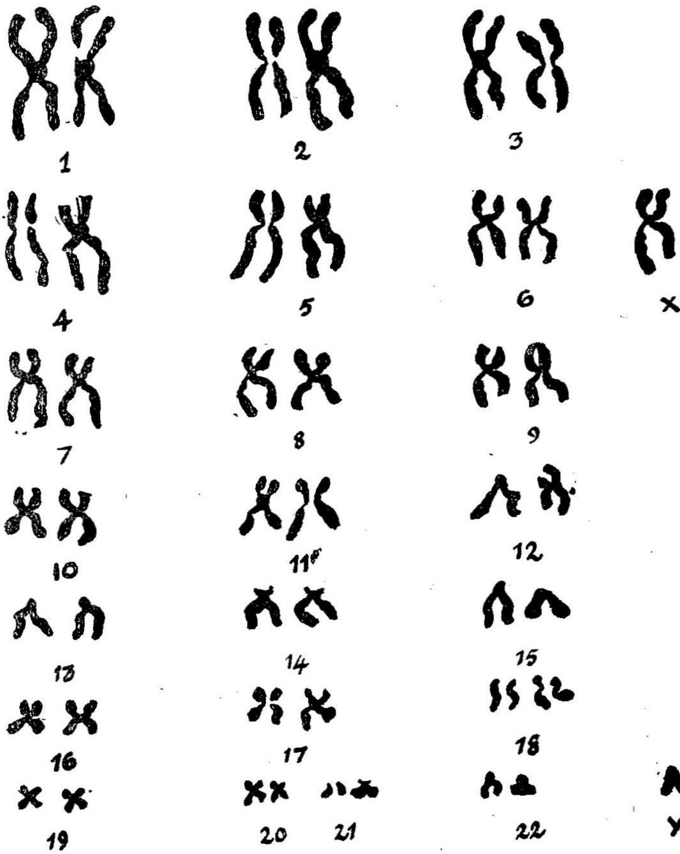


Fig. 2-1 Chromosomes

Genes : The genes, that we have discussed earlier under the heading of genetics, are the primary elements in heredity. They are found in chromosomes. If a chromosome is examined under a very powerful microscope a string of beads like material is seen. It is actually a string of genes arranged in an order. They are found in thousands. The genes are equally distributed

in chromosomes. They also come in pairs like the chromosomes. Usually the genes do not stay in their own chromosomes. The genes from one chromosome will break off and go into another chromosome and exchange the chromosomes. This process is known as crossing over.

The genes of any given pair are alike and produce resemblances between parents and children. In certain pairs they may produce differences between parents and children. But there would be more resemblances between parents and children than differnces. The genes may differ in certain pairs. Sincs the genes are in thousands with different traits it is not likely that two human beings would have the same characteristics though they were born to the same parents, except in the case of identical twins.

For example, let us take the case of a pair of genes One of them produces blue (B) eyes and the other produces brown (b)

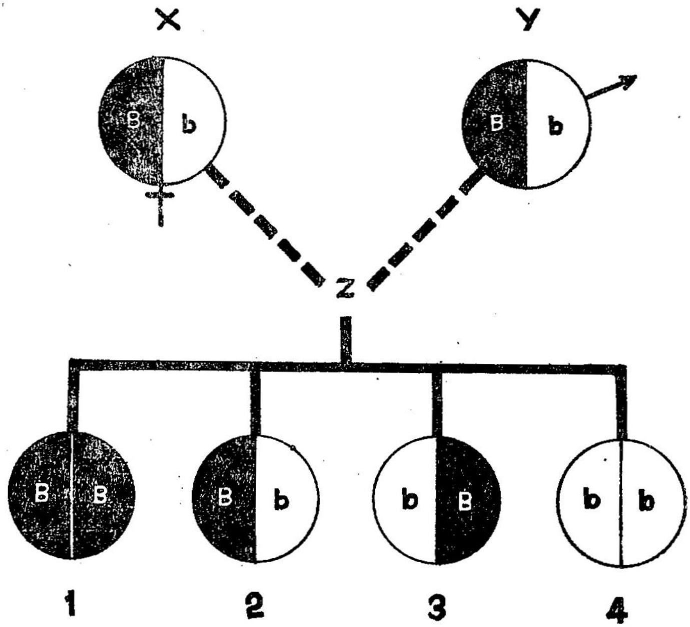


Fig. 2-2. Transmission of eye colour. X=Brown eyed mother. Y=Brown eyed father Z=Offspring 1,2,3=Brown eyes 4. Blue eyes.

eyes. If the child receives 'B' genes from both the parents he will have blue eyes. If he receives 'b' genes from both the parents he will have brown eyes. But if he receives 'B' genes from his father and a 'b' gene from his mother he will have blue eyes. Here the 'B' gene is dominent and the 'b' gene is recessive. Similarly, if he receives a 'b' gene from his father and a 'B' gene from his mother he will have brown eyes. This means, the 'b' gene is dominent and the 'B' genes is recessive.

Sex-Linked Genes : There are 23 pairs of chromosomes in human cell. Of these 23 pairs 22 pairs are having similar and equal characteristics and contain the same genetic information. These characteristics are common to the chromosomes of both the sexes. The twenty third pair alone differs in characteristics and informations. We may call this pair as sex chromosomes, because it is this pair that determines the sex of a person.

The sperm cell and the egg cell have each 23 pairs of chromosomes. During the process of fertilization, the 23 pairs of the sperm cell join with each of the 23 pairs of the egg cell completely. This process is very much needed for proper cell functioning.

Females have two X chromosomes (XX) and males have one X and one Y chromosomes (XY). These two chromosomes are named as X and Y because they look like X and Y letters. If both the parents (father and mother) contribute an X chromosome the child will be a female child. But if the father contributes Y chromosome then the mother has to contribute only the X chromosome. In this case the child will be a male child. So the male inherits an X chromosome from his mother and the Y chromosome from his father. Therefore, the Y chromosome of father has the fundamental biological characteristics to determine the sex. The Y chromosome contains certain genetic source which is the cause of the development of testes and male characteristics. All other sex developments are due to environmental factors.

Genetic Abnormalities :— When a cell is fertilized, first it divides into two divisions and then they go on multiplying in number. Sometimes, during this process part of a chromosome may be lost or the female may possess only 45 chromosomes.

One is lost. This may result in the death of the organism. This means that the fertilization is not complete and perfect. But if the organism survives a female child may be born with one X chromosome (XO) and not with two chromosomes (XX).

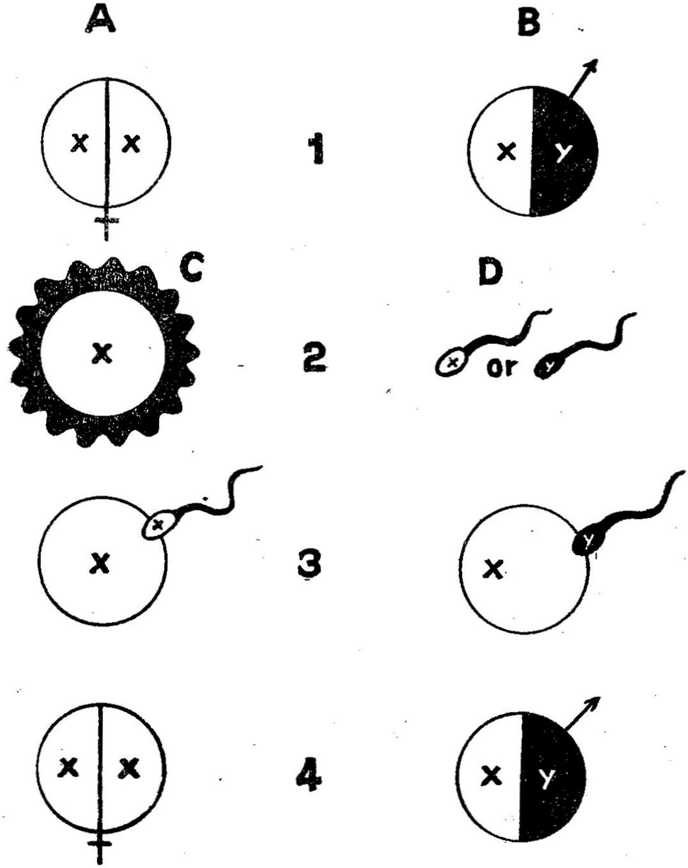


Fig. 2·3 Determination of Sex. A. Female B. Male C. Egg D. Sperm 1. Parent 2. Germ cell 3. Conception 4. Offspring.

This kind of abnormality is called Turner's syndrome. Females in this condition lack verbal abilities, spatial abilities. They may develop webbed neck and fail to develop sex characteristics at puberty.

Another abnormality due to sex chromosomes may develop in males. It causes breast development in males. The males may fail to produce sperm. It may also cause mental retardation The genetic make up of such patients is two x chromosomes and one y chromosome (xxy). This abnormality is called Klinefelter's syndrome.

There is another type of chromosome abnormality. Men will have the extra Y chromosome (XYY). Normally they are taller than the average men and are extremely aggressive. The extra Y chromosome causes the adrenal glands to secrete large amount of male hormone. These persons reach sexual maturity earlier than the normal males and have abnormal sex drive. Further, they may be violent and have high criminal tendencies. The cause of their aggressive behaviour is social and not physio-logical.

Polygenic Inheritance: The interaction of many separate genes determine most of our traits. Sometimes a single gene may have influence in many of our traits. In most of the cases the interaction of several genes determine a single trait. This process is called polygenic inheritance. The genes that determine a particular trait may be found in one chromosome or may be equally distributed in several chromosomes. For example, in most people there is no absence of intelligence. It is distributed over wider range of population. The same is true in the case of height. The height of most people fall in the middle of the distribution. In most of the cases a person's intelligence is determined by the interaction of many genes that influence different abilities. In the development of a particular trait the influence of the environment also must be taken into account.

Twins: In genetics we study mainly the similarities and the differences in human behaviour. Family inheritance shows that there are certain traits in families. The difference among them, therefore, may be due to environmental factors. There may be certain talents in families. For example, a man may become expert in certain fine arts like music, dance or painting. His son also may develop the same taste. Is it due to genetic potentialities or training ? Was Beathovan's father a musician ? was Shakespeare's father a poet-play-wright ? Have these two

persons inherited the trait genes from their parents? They need not inherit. Here heredity means individual differences, except in the case of identical twins.

Sometimes a mother may give birth to two children at the same time one by one. These two children are called twins. Twins are of two kinds. One is identical twins and the other is fraternal twins. The identical twins have more psychological importance than the fraternal twins. Because, they are genetically identical and resemble each other in many respects.

The fertilized ovum first divides into two divisions. These two are exactly the same. The two divisions divide into four, four into eight and go on multiplying into millions and developing. This process is called cell division or mitosis. The cell divisions develop first into muscle cells, nerve cells, bone cells, gland cells and skill cells, etc. and later develop into various parts of the body, like head, eyes, limbs and trunk. This process is taking place in the normal course of cell division and development. This matter we have stated elsewhere in different context in precise form. But here it is important to state the same matter little more in detail.

But sometimes the fertilized ovum after making the first division into two, may start functioning like two separate fertilized cells. The two divisions do not mix with each other in further divisions. As a result of it two organisms grow to develop into two individuals and two children are born. They are called identical twins. They have been developed from the same Zygote, called monozygote.

The other kind of twins, fraternal twins, are born from two different egg cells. Sometimes the mother may produce two egg cells or ova and both may be fertilized by two different sperm cells from father. These two fertilized ova also will under-go the same processes of cell division and development as the processes we have described above. But they develop as two separate embryos. Therefore, fraternal twins are genetically separate individuals. They mave have certain similarities like any other siblings in the family but not like identical twins. Fraternal twins sometimes may vary in sex, one may be male and the other may be a female. But in most of the cases they

are of the same sex, either both are males or females. There is every likelihood that giving birth to twins is also determined by heredity. Generally aged husbands are likely to conceive twins irrespective of the age of the wives.

Environment

The characteristics that a man inherits through genes are passed on from one generation to the next without any change. Since we associate our traits with the genes, we say that they do not change. But genes change by chemical processes. Therefore there are conditions in which the genes and the traits may be made to change. The fertilized ovum at every developmental stage is nourised by some internal environment-the uterus. This shapes fetus and also the behaviour of the organism. But there may be differences in the environment after the birth of the child. Muller says that X-rays could alter the genes permanently. This kind of change may take place even before the birth.

The genes are in the chromosomes and the chromosomes are surrounded by cytoplasm. Events may occur in chromosome, in the cytoplasm or in the cell and even outside the cell and can have change in the genes. Therefore the cell environment itself can influence the genes. It may take place even earlier to the process of fertilisation. The genes may be identical, but the cytoplasm may be different. This will influence the genes. Therefore, the genetic make up of the embryo may be influenced by this kind of environment. For example, certain kind of fish in a chemical solution develops one eye only and not two. It is also observed that certain rabbits change their skin colour according to the climatic conditions. It is the temperature that changes the expression of the genes. This shows that genes could retain the characteristics of the organism only to certain extent and not permanently. There are acids and sugars that may have influence upon the intellectual abilities. Zimmerman and others found that glutamic acid accelarates mental functioning in human beings. We cannot neglect the effects of food, vitamins and minerals and health and diseases upon the genes.

Therefore, it is evident that the genes themselves are influenced by various kinds of environmental conditions. The term environment in psychological studies is referred to all sorts

of chemical products, the physical structures and forces that surround and impinge upon the organism. It also means the surrounding conditions of the organism that influence and modify its behaviour. Therefore, the term environment is referred to the conditions of physical structures, forces and the conditions of cultural and social factors.

Interaction of Heredity and Environment.

Any organism for its development requires the interaction of heredity and environment. Either the heredity or the environment can never independently shape an organism. Both the factors are equally responsible for the development of an organism. Which is important ? Heredity or environment ? Both are important. But to what extent heredity determines the given trait and to what extent environment does it ?

Several studies have been made to find out answer for these questions. Experiments were conducted, both on animals and on human beings. The rats are the most suitable animals for psychological experiments in laboratories. Tryon has selected a set of bright and dull rats. They were made to run the maze. The number of trials were nineteen. It was found that the brightest rats made only 14 errors in learning the maze where as the dullest made 174 errors. The bright females then mated with bright males and the dull females with dull males. The offsprings of these rats were tested on the same maze. Again the bright female rats mated with bright male rats and the dull females with dull males. This was done on the basis of their ability to run the maze. This kind of selected breeding experiment was carried out for 18 generations. But the performances of these rats were tested in the 3rd, 7th and 9th generations. After the 9th generation, it was found that the dullest of the bright set of rats were brighter than the brightest of the dull set of rats.

At this stage changes were made in the environmental conditions. All the rats were given the same care. The pops of the bright mothers were cared by the dull mothers and the pops of the dull mothers were cared by the bright mothers. After few years Searle in Tryon's laboratory tested the rats' learning abilities. He found that the bright rats were not

bright in everything and the dull rats were not dull in everything. There were different patterns of abilities in the rats. The changed environmental conditions have altered the learning abilities of the rats.

In studying the learning abilities in rats Tryon found that the capacity to learn this particular maze problem was not linked with the capacity to solve other problems. Further, the characteristics of brightness and dullness of the rats were applied to the particular task involved. Therefore the dull rats were not lacking in general intelligence. Tryon's experiments on rats were further continued by Cooper and Zubek. They have raised one group of bright and dull mixed rats in plain surroundings and another group of the same type in a stimulating environmental conditions. When the rats of these two groups were grown they were made to run the maze. Actually there was no difference between the rats that were bright and dull formerly. This indicates that the inherited abilities of the bright rats had not shown any difference.

Psychologists believe that the same results could be observed in human beings. In studying the contributions made by heredity and environment the behaviour :of identical twins receive our attention. Identical twins are genetically the same. Therefore if there is any difference in their learning abilities it is due to environmental factors. In one of the studies made by Newman and others 19 pairs of identical twins were separated at different age levels. They were all young and brought up separately in different homes. Different educational opportunities were provided to the twins. The educational performances and the I Q.'S. were tested. It was found that there was significant difference between the twins.

The investigation made by H. M. Skeels among the orphan children reveal the fact that stimulating social environment was the cause of increase in the children's I.Q.'S. There were only four attendants for 35 orphan children. They were responsible for washing, dressing, feeding all the 35 children. The attendants did not find time to talk to the children. So there was no play, on learning and no story for them. There were many subnor-

mals and were sent to the institution of mentally retarded. Skeels was interested in two children. They were sent to a ward for adult women. Skeels tested the I.Q of these girls before going into this ward and after spending a year there. He found that they were mentally retarded in the beginning and became normal after one year stay. Skeels repeated his study on other children also He was greatly surprised to see that the I. Qs of some 13 children had risen from 64·3 to 93 when they were made to stay in adult wards. They had all the facilities there to play with, to read something and learn. They received all the encouragements from adult members. But the I. QS of the children who were left in the orphanages reduced from 86 to 61. If intelligence were stable and hereditary characteristics were unchanged these changes could not have occurred in these children.

Some psychologists suggest that the socio-economic status and the family size determine the I. Q. level in children. Usually middle class mothers play with their children and encourage them. Lower class mothers and mothers with more number of children do not play with their children. They do not provide their children with stimulating environmental conditions. This lowers the I. Q. levels and destroys the curiosities of poor children.

It is true that some general abilities are inherited. But, unless the child is placed in stimulating situation and activated to work there is no chance for the development of his intelligence. Therefore neither the heredity nor the environment is individually responsible for the development of an organism. Both are jointly shaping the individual's abilities and characterristics. The genetic potentialities must be nourished by the environment. For example, a good seed will not germinate in a bad soil, nor a bad seed will germinate in a good soil. Therefore the organism is the product of both heredity and environment. Woodworth says that the individual does not equal heredity + environment, but does equal heredity × environment. According to him, it is like the rectangle having the base and an altitude. The heredity is the base and the environment is the altitude and the individual is the area of the rectangle. Therefore,

we cannot conclude whether an organism is having more of a heredity or an environment. Both are equally important.

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CHAPTER III

BRAIN AND NERVOUS SYSTEM

Introduction

The fundamental task of psychology is to understand behaviour. But, what is meant by behaviour? We think of behaviour in terms of response. Behaviour is a response or a series of responses that the individual makes in an environment. Responses can be seen in various forms. Raising the hands to catch the approaching cricket ball, swinging the tennis racket to hit the ball, kicking the foot-ball into the goal, running and getting into the moving train, eating the breakfast, writing a letter, reciting a poem, recalling a pleasant event, feeling happy on winning a match, feeling sorry for a painful event, all refer to behaviour. There are also other kinds of behaviour which may be called responses. When you are asked to describe a story you read yesterday you do so. This is a response. What are these responses ? Responses are movements of muscles. They do not occur by themselves. They are aroused by stimuli or by stimulus situations.

Stimulus-Response mechanism

Stimulus : What is a stimulus ? Stimulus means a goad or sharp stick. It is used for driving animals. The bullock cart man or the horse man uses the goad or stick to drive his animal and also supplements with sound. Similarly the stimulus is used as goad to the sense organs or receptors. For example, light is a stimulus to the eye. But it is a stimulus to the whole organism. The whole organism reacts to this stimulus even though it attacks only the eye. Within the organism a chainlike activity is going on.

Therefore, a stimulus may be defined as an energy change in the physical environments that excites the sense organs. The

change in energy may lead to seeing, hearing, tasting, smelling. The sense organs stimulate the sensory nerves and they in turn stimulate the brain or the spinal cord. From the spinal cord or brain the motor nerves receive stimulation and they move the muscles. So the seeing of an object and responding to it may be explained in this way.

Object-→sense organ-→sensory nerves-→Brain or spinal cord

moving the object←—muscle←—motor nerves←——

These are the functions taking place inside the organism when an individual sees an object and moves it.

When your lecturer calls your name from the attendance register, you immediately stand up and say "Yes. Sir." The lecturer's voice of calling your name is a stimulus and your giving attendance as "Yes, Sir," is the response to it. This is in the class room situation. Some one, your father, mother or friend may also call your name and your response is not the same. It varies because the environment is different. Therefore a specific stimulus produces a specific response. Krech and Crutchfield say that a stimulus is a physical energy that can excite a receptor (sense organ) and thus produce an effect on the organism. If the energy fails to produce an effect, it is not properly called a stimulus. According to Woodworth, any force acting on a receptor making it to activate is called a stimulus.

Response : It is through stimulus that we speak of response. We believe that every stimulus is supposed to arouse a response in an organism. But all physical events do not become stimuli, because some events fail to arouse responses. Only those events that can arouse response may be called stimuli. Therefore, a response refers to an activity behaviour in an organism that is instigated by a stimulus. On this ground, therefore, we are compelled to speak about these two terms together as they are interdependent. Generally any behaviour of an organism is called a response. A response may take place in some part of the organism. But the organism functions as a

whole. Therefore, Woodworth says that we need not limit a response to a muscular activity. According to him any kind of activity instigated by a stimulus can be called a response.

There may be also indirect responses. When you attend to some musical performance and enjoy it, you nod your head, move your finger, recite the song within yourself. These are responses to the performance. This is a sensory response to sound-the music. After some days you hear the same song in a radio programme and you remember it. This is another activity aroused by the sound-the music. You have recalled all those things of the past. Therefore, it is an indirect response to sound-the music. A related external stimulus may arouse series of responses in an organism even though that was not present there.

Stimulus-Response Formula : In evolving a stimulus response formula we must take into account the definitions of both the terms given above. A stimulus elicites a behavioural response in an organism. The letter 'S' stands for stimulus and 'R' for response.

$$S \longrightarrow R$$

The formula means a stimulus arouses a response or a response is aroused by a stimulus. According to this formula a response depends upon a stimulus. But at the same time we cannot conclude that a particular stimulus will arouse the same response in all the organism. There may be individual differences in behaviour and the individual differences may be based upon the auditory sensory apparatus. Therefore, when a stimulus (S) is presented to an observer (O) it arouses a response (R) in him. Thus response depends upon two factors first on the stimulus and second on the organism. The formula is $S \longrightarrow O \longrightarrow R$

The stimulus acts upon the individual and makes him to respond to it. The type of response the organism has made depends upon the nature of the stimulus properties and the nature of the organism. There are certain characteristics attached to the stimulus which may be called stimulus factors

S-Factors and also to the organism which may be called O-factors. The stimulus factors may be the strength of the stimulus and the relevance of its arousal. The O-factors may be the strength of the sensory apparatus, the state of the organism.

The strength of the stimulus refers to the intensity and size of the stimulus. The relevance to the cause of the stimulus. If an organism is to respond to a bell, any bell will not arouse a response in it. For example, there are several kinds of bells such as the temple bells, church bells, college bells, railway station bells. The church bells will not arouse response in a Hindu or Muslim devotees. Even among the church bells, it may be for the usual prayer or for a special communion or for funeral ceremony. The differences make the organism to respond relevantly.

With regard to O-factors, the sensory apparatus or sense organ must be in sound condition so as to receive various kinds of stmuli and differentiate the meanings. Two persons must attend to the same function. One attends and the other is not. He says that he did not hear the bell. The absence is due to the difference in the sense organs. The structure of the organism and the sensory apparatus have certain permanent characteristics in the organism. Woodworth says that the genes that shape the characteristics of the whole organism is responsible for the non-response of the organism.

Secondly, the organism may not be in a state of awareness to respond to the stimulus. It also depends upon the readiness of the organism. A state of drowsiness, fatigue, boredom, depression, worry, extreme excitement, sickness and unpleasant news all have effect in the type of response the organism will make to a given stimulus.

Thirdly, how is important the stimulus to the organism at the particular moment ? The individual is already engaged in some kind of activity in response to some stimulus. Another stimulus at this moment may put him in a fix. He is to respond to it or not ? It depends upon the nature of the stimulus. If it is going to put him in a better position, he would respond to it

immediately. Otherwise he may ignore it or resist it. Therefore, in evolving a stimulus - response formula all these factors must be considered.

Basic units of the Nervous system.

We have been, so far, looking into the stimulus - Response mechanisms based upon the behaviour of the organism. But what is going on inside the organism ? If we want to know more about what is going on inside the organism, we must know more about the nervous system. The nervous system is a complex pattern. It controls and regulates the individual behaviour. In all the sensory activities the individual is regulated by the nervous system. Physiologists, anatomists and chemists studied nervous system with a hope of getting more information about the behaviours. Psychologists and physiologists have many things in common in human behaviour. Physiological psychology studies the relationship between physical structure, function and biochemistry on one hand and behaviour and experience on the other hand. In a broader sense it is called Biopsychology.

, *Reflex action :* Biopsychology is a branch of science that studies mainly the role of the nervous system in behaviour. The biopsychological basis of behaviour is divided into three functions. They are the receptors, nerve cells and effectors, Each function is having its basis in different bodily structure (mechanism). They are doing the functions of receiving, connecting reacting mechanisms respectively. These three kinds of mechanisms cooperate and produce (simple sensory-motor) reflex actions. We may call this function as sensory-motor reflex action.

Reflex actions are simple involuntary actions. They are innate in human beings. The actions are profound and aroused automatically and unconsciously in response to certain stimuli. There are several reflex actions. If there is a pin prick suddenly in your finger you immediately give a jerk and jump and try to withdraw from it. Similarly, we withdraw our hand from a burn, mild electric shock. An unexpected sudden loud noise

behind you would make you to twist your body. An irritation in your nose may cause you sneezing. We all blink at a very bright light. When somebody tickles your body you jump instantly. These are all some of the reflex actions. In reflex action generally there is a tendency to withdraw our body from the source of painful stimulation.

When some one pricks your skin with a pin you experience a painful feeling and at once you withdraw from it. It is called protective reflex. When the pin enters your skin it activates some tiny sensory nerves or receptors. The message is immediately transmitted through connecting mechanism to the spinal cord. It is not necessary to go to the brain. A message from the spinal cord is sent through the motor nerves and the contraction of the muscles takes place.

Skin (pinprick) → Sensory nerves → Spinal cord

Muscles ← Motor nerves ←

The communication process from a sense organ through the nerve centre to the muscle is called a reflex arc.

Neurons : The nervous system is an important coordinating and integrating mechanism of the body. The nervous system is involved in the extraordinarily intricate activities of the body. The parts of the nervous system are many and complex. But it is easy for us to understand it if we approach it through its various parts. The smallest part is the individual neuron.

The nerve cell or neuron is the structural and functional unit of the nervous system. The structure of the neuron is the branching filament or minute fibres with a cell body in it. It has been estimated that there are twelve billion neurons or nerve cells in human body and it is they that make up the nervous system. Neurons are of different sizes and shapes.

A neuron is a living cell. It has all the parts that all other cells have. For example, the nucleus, the cytoplasm and the cell membrane are common to all the cells. What makes the neuron do differ from other cells ? They are the

specialised parts of the neuron. There are many short fibres extending from the cell body. They are called dendrites.

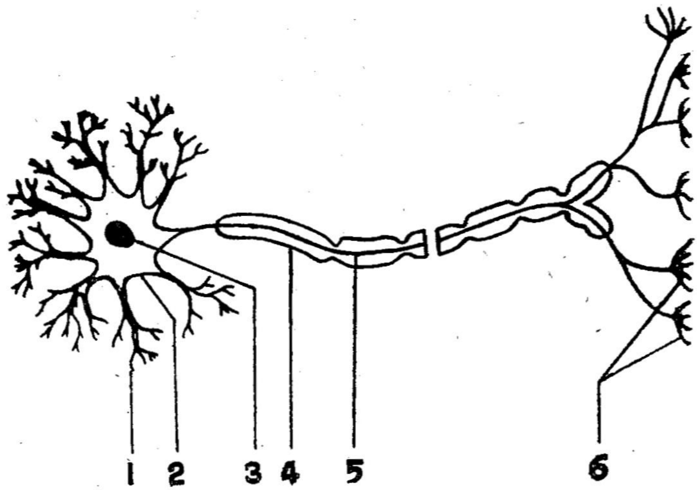


Figure 3.1 A typical Neuron. 1. Dendrites 2. Cell body 3. Cell nucleus 4. Myelin sheath 5. Axon 6. Terminal branches

The dendrites receive messages from surrounding cells and carry them to some distance and pass them on to the nearby cells. There is a single long fibre extending from the other side of the cell body. It is called axon. The fibre of an axon is very thin and longer than the dendrites. In adult human being it is about three feet long but most of them are short. The axon carry messages to outside either to the next neuron or to the muscles and glands. Therefore, the neurons do the work of coordination from one part of the body to another.

When we speak about a nerve it is a group of axon bundled together. In a nerve bundle there may be thousands of neurons. The axon is covered by a fatty substance called myelin sheath. The sheath is like an insulator. The neurons are of three kinds. They are afferent or sensory neurons, efferent or motor neurons and association or inter neurons. The afferent neurous collect messages or impulses from outside and inside of the body and carry them to the spinal cord or brain.

Secondly, the efferent neurons carry messages from the spinal cord or brain to the muscles and glands. Thirdly, the association neurons that are smaller in size connect the afferent an afferent neurons. They are found in the spinal cord and brain.

The nerve impulse : This refers to the action of the nerve fibres. A Nerve impulses is an electrochemical discharge of a nerve cell. Nerve impulses are conducted through axon or dendrites. A single neuron functions in the same manner as the

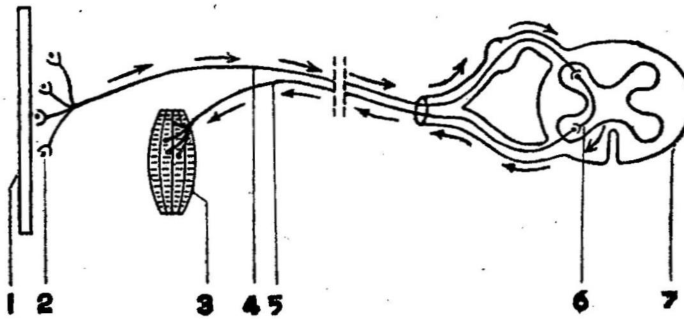


Fig. 3.2 A Simple reflex arc.

1. Skin. 2. Receptors. 3. Muscle cells (effectors) 4. Afferent nerve fibres, 5. Efferent nerve fibres 6. Association neurons. 7. Spinal cord.

fuse of a fire cracker. If it is activated once a small electro-chemical action (nerve impulse) runs forcibly along the length of the nerve fibre. It is the basic message unit. Every firing neuron functions in the same manner. The same amount of energy is spent and transmitted each time. The main point is that if a neuron fires at all, it fires completely, otherwise it is not. It obeys all-or-none law. Once a neuron is fired, it cannot be fired again until its electrochemical conditions are restored. But the amount of time taken for this process of restoration is one–thousandth of a second (·001,) The nerve impulses are weak and have little energy, but able to arouse action in muscles and nerve centre. In these processes there are two kinds of transactions. One is that messages through afferent neurons are taken along the membrane of the body cell and fibre to the spinal cord and brain and the other is sent from spinal cord and brain to the efferent neurons or muscles. The messages (impulses) are taken on either side. This process is

called nerve impulse. The speed of the nerve impulse depends upon the size of the fibre. The speed is slow in small fibres and fast in fibres of large diameter.

The synapse : We have been, so far, considering the function of a single neuron. The neurons do the work of co-ordination of the body activities. How does it take place Each neuron remains separate and there is no physical connection between two neurons. A nerve impulse begins when one of the dendrites of a neuron receives a message. There may be several dendrites in a neuron. These dendrites carry the message to cell body and from there to the axon. The axon terminates a place where there are tiny branches known as axon terminal. The axon terminal of a neuron is put close to the dendrite of another neuron. There is a very small gap between the two. This gap is called synapse. This is a junction or area where an axon of one nerve cell meets a dendrite of another cell. The nerve impulses somehow travel through gap. An important characteristics of the synapse is that it allows impulses to pass in one direction only, that is from axon to dendrite. The axon is the conductor and the dendrite is the receiver.

The idea held for long time was that nerve impulses run so fast that they jump across the gaps. But a recent discovery in this field says that the transfer is chemical and not electrical. According to this theory some axon terminals have tiny oval sacs called synaptic vesicles. The synaptic vesicles contain some chemical transmitter substance. When the nerve impulses go near the end of the axon, it makes these vesicles to burst and releases the chemical substance. This substance actually travels across the gap and makes the second neuron to fire. There are several chemical transmitter substance. But all of them do not make the second neuron to fire.

There are certain complicated functions in this process. Each neuron can effect the activity of thousands of other neurons and in turn may be affected by them. Therefore each neuron is indirectly connected with every other neuron in the whole nervous system.

Structures and Functions of the Nervous System

The human nervous system is a very complicated one. If we are interested in knowing more about the roles played by

the nervous system in human behaviour we must know something about its anatomy. The nervous system contains many parts. But all of them can be brought into two divisions. They are (1) The Central nervous system. (2) The peripheral nervous system.

Divisions of the Nervous System : The central nervous system consists of the brain and spinal cord. They are two distinct structures. The brain lies within the skull, a bony case. The brain is the most important part of the body. It is the seat of awareness and reason. The spinal cord lies in the spinal column.

The peripheral nervous system is the part of the nervous system that is lying outside the skull and the spinal column or bone back. The peripheral nervous system carries informations to and from the central nervous system. It is further divided into two divisions on the basis of the functions. They are the somatic nervous system and autonomic nervous system. The somatic nervous system serves the sense organs. It is also concerned with the body movements and the reaction to changes in the environment. The autonomic nervous system contains mainly the motor nerves. It controls the smooth muscles and glands of the internal organs of the body. The autonomic nervous system is divided into two divisions as the sympathetic nervous system and parasympathetic nervous system. The functions of these two systems are quite opposite to each other. But we are not studying the autonomic nervous system in this section.

Diagram of the structure of the nervous system.

- Nervous system
  - Brain and Spinal cord
  - Peripheral nervous system.
    - somatic nervous system
    - Autonomic nervous system
      - Sympathetic nervous system.
      - Para—sympathetic nervous system

The Central Nervous System

The central nervous system consists of the spinal cord and the numerous structures of the brain. The nerve structures of

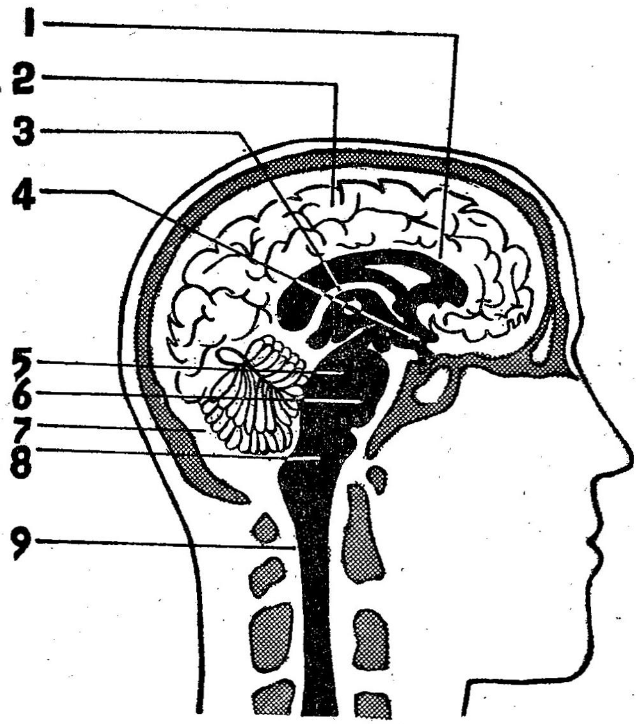


Fig. 3.3 The cross section of a human brain

1. Corpus callosum. 2. Cerebral hemisphere. 3. Thalamus. 4. Hypothalamus. 5. Mid brain. 6. Pons. 7. Cerebellum. 8. Medulla. 9. Spinal cord.

the central nervous system are completely different from that of the peripheral nervous system in several ways. The neurons in the central nervous system are grouped into structures. The brain alone contains about ninety percent of the neurons of the nervous system. But the basic function of the neuron is the same in the whole body. The peripheral nervous system takes the informations into the central nervous system and away from it. The central nervous system, on receiving the informations,

does the functions of organization and integration. These functions are taking place as network as no section of the central nervous system operates independently. Each part adds its activity to the total function of the body.

The Spinal Cord: The spinal cord is a part of the nervous system enclosed within the backbone. It is the bundle of complex nerve fibres going through the spinal column. The spinal cord connects the brain to the rest of the nervous system. The spinal cord is made up of long and sylinderical nerve fibres. There are two distinct component in the spinal cord, 1. the white matter and 2. the gray matter. The outside part is made up of white matter. The myelin sheath of the axon gives it the white colour. The gray matter is inside. It consists of cell bodies of neurons. The white matter contains conducting paths. The nerve fibres in the white matter carry informations to and from the brain. Therefore, the spinal cord is primarily dealing with the transmission of impulses between the brain and the peripheral nervous system. The sensory impulses sweep through the ascending neural pathways towards the brain. The efferent or motor impulses violently go through the descending pathways to the muslecs and glands. The two neural, ascending and descending, pathways to the brain and from the brain go through the spinal cord only. But sometimes certain sensory stimuli evoke sudden motor responses at the spinal cord. This is called spinal reflex. The b ain is not involved in this. For example, the knee-jerk reflex is produced by sharp tap to the knee. The tap to the knee is the stimulus and it produces impulses. These are to be transmitted through peripheral sensory nerve to the spinal cord. The spinal cord connects the impulses to the peripheral motor nerve and activates the leg muscles. This kind of simple reflex activities may take place at :the spinal cord level. The spinal reflex actions are protective.

The brainstem : The spinal cord at its upper end enlarges and merges into the lower part of the brain. This part is called the brainstem. It integrates and controls the involuntary activities of the body. It contains the oldest structures of the brain.

The brain : The brain is the most fascinating part of our body and important for the study of human behaviour. It is involved in all complex activities like perception, learning, thinking, problem solving and so on. In order to understand all these complex activities we must go into the details of the structure, the divisions and their functions. The human brain is composed of three main divisions. They are, (1) the hind-brain, (2) the midbrain and (3) forebrain.

1. *The hindbrain* : The hindbrain is the earliest to evolve in the brain. It consists of the medulla, the pons and the cerebellum.

The medulla is the lowest part of the hindbrain. It is a narrow structure and has centres to control the primary physiological mechanisms of the body such as breathing, heart beat, temperature control and many important reflexes like maintaining our upright posture. It is a point at which nerves from higher parts of the brain are crossing to the left and right.

The pons lie just above the medulla. Pons means bridge. The pons consists of nerve fibres that connect the brain cortex to the top portion of the hind brain and medulla. It is an integrating centre for ascending and descending impulses. The pons are responsible for the sensory and motor functions of mouth and face.

The cerebellum lies behind the brainstem. It is one of the centres of motor co-ordination. It is made up of circular portions. The outer surface of it is the cortex. It is a gray substance. It is responsible for a number of co-ordinating activities like motor co-ordination and sequences in movements. Any injury in this part would destrsoy the sequences in movements.

2. *The midbrain* : The midbrain lies above the pons and cerebellum and also in between the hindbrain and forebrain. The midbrain is a complex centre where there are synapses for the visual and auditory nerves. It aids in regulating the body for auditory stimulations.

But there is a system that goes through the parts of hindbrain, midbrain and forebrain and perform certain

functions. The system is called the reticular activating system. It is included in the midbrain. The reticular activating system is made up of netlike bundle of neurons which functions as an arousal system. When the system is activated it alerts the higher centre of the brain to receive and integrate the stimuli. It also regulates the sympathetic nervous system. When two or more messages are received at the same time, the one that is most important is decided by the reticular activating system.

3. *The forebrain :* Of all the three parts of the brain, the most important one is the forebrain. In the evalutionary process forebrain is evolved lastly. It is widely bulged out above cerebellum and occupies the entire upper portion of the skull. It is a mass like substance, greater than the other two brains put together. The outside appearance of the forebrain is like two great circular hemispheres.

The forebrain contains three important areas. They are the cerebrum and cerebral cortex, the thalamus and hypothalamus and the limbic system. These are having psychological importance for explaining the human behaviour.

The Cerebrum and Cerebral Cortex : These two have the same structure and they are inseparable. Therefore we are dealing with these two jointly. The cerebrum is highly evolved complex part of the brain. It appears to be two hemispheres. The inner portion of the cerebrum is a big mass like substance white in colour called corpus callosum. This corpus callosum connects the two hemispheres and other parts of the nervous system. It is like the roof over thalamus-another inner part. The outer layer of the cerebrum is made of gray matter called cerebral cortex.

The cortex is a covering, which encloses the whole of forebrain and midbrain. The cortex that covers the cerebrum is called cerebral cortex. The area of the cortex is about six square feet. The area varies from brain to brain in mammals. The surface area of the cortex appears to have many ridges or convolutions. These convolutions vary in every brain and from individual to individual. No two brains will have same convolu-

tions. These convolutions are also called sulcus or fissures. The fissures are of different sizes and large fissures are used to divide the cerebral cortex into different areas. In the middle of the forebrain runs a deep fissure which divides the cerebral cortex into halves. The divided halves are called cerebral hemispheres. The dividing deep midline is called longitudinal fissure.

There are two fissures with prominent landmarks in the cerebral cortex. They are the central sulcus or fissure of Rolando and the lateral fissure or fissure of sylvius. These two. divide the hemispheres into four lobes. The central sulcus is a groove in the cerebral cortex at the top. It divides the frontal lobe from the parietal lobe. The first hemisphere consists of mostly the frontal lobe. The lateral fissure is a deep crevice in the cerebral cortex at the lower level. It divides the temporal lobe from the frontal and parietal lobes. Actually the lateral fissure divides the second hemisphere into three lobes, temporal, parietal and occipital. These lobes are generally called the projection areas.

The frontal lobe : Of all the four lobes this is the biggest one in the cerebral area. It contains the motor projection areas and the speech controlling areas. This is responsible for reasoning and problem solving. The forward portion of the frontal lobe is involved in concentration and the ability to plain and carry out sequences of activities. It is the expressing part of the brain.

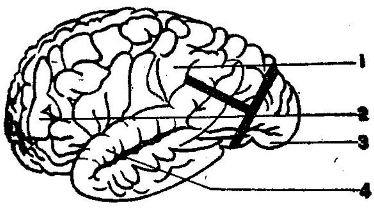


Figure 3.4 A side view of the human brain

1. Parietal lobe
2. Frontal lobe
3. Occipital
4. Temporal lobe

Temporal lobe : This lobe lies below and on the sides of the lateral fissure. It has the auditory projection areas. It is divided into large number of areas. Most of them are association areas. Several autonomic functions like respiration, change in blood pressure are also affected by electrical stimulation of some portions of temporal lobe.

Parietal lobe : The parietal lobe lies behind the central fissure. This is primarily concerned with incoming sensory messages. It contains somesthetic sensory projection areas. Functionally it is related to occipital cortex. This is responsible for the sense of touch, pain and temperature.

The occipital lobe : This portion of the cortex lies right below the parietal lobe. There is visual projection area in this lobe. Nerve impulses going from the eyes through the optic nerves terminate at occipital lobe.

The Thalamus and hypothalamus : The thalamus is one of the most influential areas of the forebrain and cerebral cortex. It lies just above the pons and midbrain. It is said that the thalamus is a complex relay and control centre for incoming informations. Even other informations that travel from one part of the cortex to another pass through thalamus. Some of the neurons in thalamus regulate electrical activity of the cortical regions and some control the actions of the autonomic nervous system. The thalamus functions like pons.

The hypothalamus is a small structure in the forebrain. It lies above the midbrain and below the thalamus. It exerts lot of influence on several kinds of motivation. The hypothalamus consists of centre which controls the activities like eating, drinking, sleeping, sexual behaviour and the control of temperature. It is also having direct control over all kinds of emotional behaviour like rage, fear, pleasure and pain. It control directly the autonomic nervous system and pituitary glands.

The limbic system : This is one of the areas of forebrain. In the centre of the cerebral hemisphere there is a ring structure involving several parts. It is called the limbic system or visceral brain. It includes thalamus, hypothalamus, hippocampus; septal and several parts of the forebrain. It is an important system in emotional behaviour and learning. It is concerned with higher mental functioning like cortex. The hippocampus is important in our memory functions. Injury or damage to hippocampus in human beings may affect the function of new memories. The limbic system controls responses like breathing, heart rate, and intestinal activity.

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CHAPTER IV

SENSATION

The Nature of Sensation

The world in which we live is full of energies and these energies attack the organisms in various rays. Physicists say that we are constantly assailed by cosmic rays, light ways, sound waves and heat waves. If we want to survive in this world we must understand the informations these forces bring us. Therefore, our bodily parts come into contact with these informations. Since our sense organs are specialized in a particular area they receive the respective informations from outside in the form of stimuli and convert them into sensations. These sensations become the basis for all our behaviours.

The sun sends energy to the earth in the form of light waves and this becomes a stimulus to the eye. The conversion of this stimulus into sensation, experience and ultimately into knowledge is an elaborate process involving four important stages. They are (1) Sensory stage, (2) Attentive stage, (3) Perceptual stage and (4) Conceptual stage. Therefore, in the knowledge getting process sensation is only the first step. For a sensation to be meaningful it should be attended and then understood. Finally, a general idea has to be drawn by organising the several particular ideas about it.

Sensation is a kind of awareness to sensory stimulation. It is aroused in an organism by a stimulus. A stimulus may be internal or external. The sensation is the act of the organism. Sensation means the activity of the sense organ of the sensory nerves and of certain parts of the brain called the sensory centres. Sensation is the first response of the brain to the stimulus which impinges on the organism.

According to popular belief, man is supposed to possess five senses. But recent physiological research has made it clear that there are eight sensory receptors. So man has got eight senses, They are vision, audition, gustation, olfactory and tactual. The other three are internal such as organic, kinesthesis and vestibular. Further each sense organ is specialized in one particular type of sensation. The ears cannot see nor do the eyes hear. Suppose a light stimulus falls on the ear, the sense organ is not activated. It should be remembered that even when a sense-organ is capable of receiving an appropriate stimulus, it responds effectively only according to certain law. There is no sense of hearing to both a very loud noise and very feeble one.

Sense Organs and Corresponding Sensations

Sense-organs	Stimulus	Sensations
1. The eyes	Ether vibrations	Visual (seeing)
2. The ears	Air vibrations	Auditory (hearing)
3. The tongue	Chemical substances dissolved in saliva	Gustatory (tasting)
4. The nose	Chemical substances in gaseous form	Olfactory (smelling)
5. The skin	Changes in temperature or objects coming into contact with the skin	Tactual or Cutaneous (touching)
6. Stomach and back of the throat	Churning of the walls of the stomach and certain chemical changes in the back of the throat	Organic (internal)
7. Muscle spindles and tendons in the joints	Pressure on the muscle spindles and the tendons near the joints	Kinesthetic (muscle)
8. The semicircular canals in the ear	Disturbances in the fluid of the semicircular canals	Bodily equilibrium (balance)

Mechanism of Sensation

In psychological studies we are interested in all these eight senses and sensations. Our concern is, how these sensations are caused. How the various forms of physical energy such as cosmic rays, light waves, heat waves and sound waves affect the receptor cells within the sense organs? How the cells convert these energies into informations and send them to the central nervous system? Therefore it is important that we must know something about the mechanism that takes place in the various processes of seeing, hearing, tasting, smelling and touching and other things.

The mechanism of sensation is more complex than we all assume it to be. For a sensation to occur in the human organism stimuli from the external world should come into contact with a sense-organ. This contact will result in the release of some kind of nervous energy which is transmitted by the sensory nerves to an appropriate region in the cortical area of the brain. When this has happened, there will be an awareness in the organism of experiencing a sensation.

Sometimes a question is asked as to which is the most important of the senses. It is very difficult to say which is important. Because the relative importance of the senses actually differs from person to person, depending upon the utility of the particular sense. However, eye receives the first importance, since it is supposed to be the most precious of all our sense-organs. A very valuable object, as we all know, is often compared to our eye. The next important sense organ is the ear. But we are not giving much importance to one sensation. It is often neglected. It is the sense of smell. Though the sensation of smell is valuable from an aesthetic point of view we give very little importance to the sense of smell in our every day life. As a matter of fact, we do like to smell anything when we get into a bad cold. On the whole, there is a great deal of individual difference, in giving importance to the value of our senses. For instance, a musician would rather be ready to sacrifice his sense of smell or taste in preference to his sense of hearing, but not a producer of perfumes or a skillful cook.

General Characteristics of Sensations

The events that produce sensation in an organism should occur in a sequential manner. Some form of energy stimulates the receptor cells in the sense organ such as the eye or ear. The receptor cells are specialized in responding to certain forms of energy called light waves of certain lengths, air pressure, the energy from chemical activity and thermal energy. There are several kinds of receptor cells. Some of the receptors in the eye and nose are specialized neurons. Others in the ear and tongue only activiate the neurons that are near to them or enclosed within them.

One of the common characteristics of all the receptors is the ability to convert the energy they receive into a form that the nervous system can understand. The process of change is called electrochemical neural impulse. The conversion of stimulus energy from one form to another form is called transduction. The sensory nerves carry the neural impulse to the central nervous system- the brain and the spinal cord. Then the impulse ends in the appropriate sensory projection area of the cerebral cortex. The sequence continues without any break.

Every receptor cell can respond to the energy that falls within its range, If the energy falls away from the receptor it will not be communicated and sensed, Even the stimulus that falls within the range must have certain amount of intensity or strength. Otherwise the receptor cell will not respond to it. For example, some voice may be heard from the next room, but the voice is not strong enough for our ear to make out a meaning from it. If the duration of the presence of stimulus is increased the stimulation in the senses also increased for a longer period.

1. Visual Sensations

The sense organ for the visual sensation is the eye. The mechanical structure and function of the eye can be roughly compared to a camera. The *retina* which is the third layer of the eye, is its sensitive plate. In the case of camera, the photographic plate has to be replaced after every exposure.

But the retina recovers immediately after an exposure and as such spontaneously ready for another. The eye ball corresponds to the box. The outer tough coat of the eye ball is known as the *Sclerotic coat.* This is the metal or the wood of which the box is built. The inside of the camera box is painted black, Similarly the inner second layer *choroid coat* is darkly pigmented in colour. This pigmentation serves the useful purpose of preventing the incoming rays of light from being reflected back.

At the front of the eye, light is admitted. This front portion of the sclerotic is transparent and it is called the *cornea.* The coloured part of the eye which lies behind the cornea is an extension of the *choroid* and it is known as the *Iris.* In the centre of the iris there is a hole, which is known as the *pupil* of the eye. The Iris looks like the diaphragm of the camera. The lens of the eye is just behind the pupil. Three pairs of muscles regulate the movement of the eye ball in its socket. The lens of the eye is adjustable by the working of the *ciliary muscle.* This is something like the focussing mechanism of the camera. The cornea also functions as a lens but it is not adjustable. The jelly-like substance-aqueous humor and vitreous humor fill in the eye ball and put it in shape. They are transparent and as such allow the light to pass through them on the way to the retina.

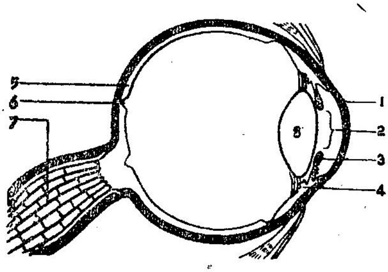


Figure 4.1. A cross-section of the human eye

1. Cornea 2. Pupil 3. Iris 4. Ciliary muscles 5. Retina, 6. Fovea 7. Optic nerve 8. Lens.

At the very back of the eye ball is the sensitive film of the eye and the third layer known as *retina* which lies below the choroid. The nerve cells of the retina are composed by *cones* and *rods.* The cones are meant for normal daylight vision while rods are used in twilight vision. Cones are receptive to colour vision but the rods can receive only light and shade. In the central part of the retina there are more cones

and this portion is known as the *Fovea*. There are millions of cones in this area. The colours are seen clearly in this region and this is the point of clearest vision. The rods are concentrated in the outer portion of the retina. Suppose a coloured light falls on this region, the observer will experience a colourless sensation.

The optic nerve is that which is formed by the coming together of the nerve fibres from the ganglion cells of the retina. This optic nerve transmits the message from the eyes to the occipital lobe of the cerebral cortex. Not far from the fovea is an insensitive area known as the blind spot where there is no vision at all. We are not ordinarily aware of the blind spot at all, unless we take special care to locate it through laboratory demonstrations.

Colour vision: There are seven colours in the spectrum and they are visible to the naked eye. The seven colours in descending order of wave length are (1) red (2) orange (3) yellow (4) green (5) blue (6) Indigo and (7) violet. They are popularly called 'VIBGYOR'. Beyond violet, we have the ultra-violet rays which cannot be seen. It is used for therapeutic purposes. Infra-red which is at the other end of the spectrum also cannot be seen. It is used in long distance photography.

Certain pairs of opposing colours when combined yield a colourless sensation known as *complementaries* There are two such pairs of complementary colours like red and green ; yellow and blue. If a ray of red light and a ray of yellow light fall on the same cone at the same time, the observer will see orange. Suppose red, yellow and blue are used at the same time, the resulting process is a neutral grey,

The phenomenon of *simultaneous contrast* can be explained by this example. Yellow and blue appear yellower and bluer respectively especially when both are seen side by side than looked separately.

After images: Suppose a ray of light acts on the retina for a certain length of time its effect will persist for a short period,

ven after the external stimulus has disappeared. This kind of sensory experience is called an after image. There are two types of after images : (1) positive after-image (2) negative after-image When both the original impression and the after image are of the same quality, then that experience is called *positive after-image.* For example, a person looks at the flame of a candle in a dark room for some time and then closes his eyes but still be able to see a flame before him for a few minutes. Suppose the quality of the after-image is different from the original impression' then it is called a *negative after-image.* This negative after-image is called *successive contrast.* Here every black changes to white, every white to black and every colour to its complimentary colour.

Colour Blindness : This is an inability of some people to distinguish between colours. It is not a disease and so cannot be cured. It is a natural condition of the eye due to the lack of development of certain zones of the retina. There are two types of *colour blindness-total and partial.* Suppose the entire retinal field is filled by rods alone, then the person will suffer from total colour blindness. But total colour blindness i a rare phenomenon. In the total colour blindness the person looks at all colours as mere variations of light and shade. Partial colour blindness is more common than the other. It is generally red, green blindness. This is very rare among women. But 3 to 4 per cent of men suffer because of this. Here the persons have sensations of yellow and blue but not of red and green. What appears to the normal eye as red, orange, green appears to him as more or less yellow. When there is violet and purple, he sees blue invariably.

From the practical life point of view people who suffer from colour blindness either partial or full need not get discouraged. In the matter of employment they can go to such of these professions or jobs which do not demand knowledge about colour discrimination. Similarly in the matter of dress selection they can seek the help of their companions or relatives who are free from colour blindness to offer better guidance and direction.

Theories of Colour Vision

It is the cones which mediate colour vision but it is not known how they do it. There are many theories of colour vision. They all endeavour to explain colour phenomena but no one of them is satisfactory. A good theory should explain the following matters (a) the number of elementary colours (b) colour mixture (c) colour contrasts (d) after images (e) colour-blindness.

(a) *The Young-Helmholtz Theory* : According to this theory there are only three elementary colours - red; green and blue. This three-component theory of colour vision was propounded by Thomas Young in the year 1801. The theory of Thomas Young was developed by Hermann von Helmholtz later and hence it is known as Young-Helmholtz theory. It explains the mixture of wave lengths and negative after images. There are three types of cones for the three colours. Yellow is generally recognized as the fourth elementary colour. But this theory looks upon yellow colour as a blend of red green. Similarly white is a compound of the three primary colours-red, green and blue.

Scientific research has not proved the existence of three such substances in the cones as it is claimed by the theory. Secondly yellow is not a compound of two colours. Physicists and physiologists treat yellow as a separate colour. Lastly the theory does not give any explanation of colour-blindness.

(b) *Hering's Theory:* There are three substances in the retinal tissue and they overlap to some degree. These three substances according to Hering are three pairs of colours-the-red-gree; yellow-blue and black-white substances. The two colours in a single substance stand in opposition to each other. Therefore if one is stimulated the other is also known into activity. Suppose both the colours in a substance are stimulated at the same time, we get white since they neutralise with each other.

This theory is an improvement on the previous one. It refers to four primary colours and has accounted colour

mixtures as well as colour contrasts. But it has failed to explain colour blindness.

(c) *Ladd-Franklin Theory :* The most satisfactory theory of colour vision is formulated by Christine Ladd Franklin. Her theory is a genetic theory. The theory makes an evolutionary approach to the problem. It believes that our present colour vision is a development from a primitive stage of colourless vision.

Ladd Franklin has Clearly pointed out in her theory that there are three zones in the human retina corresponding to the three main stages of evolution. In a primitive stage of vision the retina was sensitive to only light and shade (white and black). Then the retina at a certain stage developed a second zone which responded to yellow and blue wave-lengths. Afterwards, a third inner zone was developed in the centre of the retina which was responsive to all the four primary colours. Also it is hoped that perhaps man at a future time may develop a fourth inner zone and as such he can see ultra-violet and infra-red rays which are at the moment not visible to the naked eye.

In the totally or completely colour-blind person the whole of the retina is in the first stage of development containing full of rods and no cones at all. But in the case of partially colour-blind person (red-green blindness) the third inner zone is in the second stage of development. So to a partially colour blind person there are really two zones only, instead of three zones. Ladd Franklin has remarked that the whole process of appreciating differences in wavelengths is chemical in nature.

In general, the Ladd Franklin theory has given us a very satisfactory account of the most difficult item like colour blindness. However, her remark that man was originally colour blind is not correct. This is because apes have colour vision and also primitive-cave-dwellers hava left behind them bright coloured drawings.

2. Auditory Sensation

Hearing is one of the most important senses in our communications with the outside world. The physical stimulus

for the sense of hearing is sound wave. The process of hearing begins when sound waves attack the ear drums and cause it t vibrate.

The human ear is a complex mechanism. It is divideod into three parts-the *outer* ear, the *middle* ear and *inner* eare The outer ear is made up of the pinna (this is what we call· the ear) and the tube which runs inside. It catches the sound waves and carry them to the *ear drum* or *tympanic membrane* of the middle ear. The sound waves push this membrane to vibrate. The area of the middle ear begins from the tympanic membrane to the oval and round windows of the inner ear. The middle ear is an irregularly shaped cavity in the skull. And across this cavity there is a chain of three delicate bones· *Hammer* (Malleus), *Anvil* (Incus) and the *stirrup* (Stapes). The bones are known by their shape. The middle ear is connected with the throat by means of the eustachian tube. This tube supplies air to the middle ear constantly. The inner ear spreads right back into the skull. It is made of three parts like the semicircular canals, the vestibule and the cochlea. The semicircular canals are responsible for the sense of balance or equilibrium which we shall discuss later. The vestibule is just a receiving and transmitting centre. The cochlea is the real organ of hearing and it is the main part of the inner ear. It is shaped like the shell of a snail. It has wound itself round two and a half times. This kind of anatomical device makes an adequate saving of space. The Basilar membrane is another important part which is running parallel similar to the structure of cochlea. It consists of thousands of fibres which vibrate like the piano strings. The inner ear is water tight and it is filled with a saline liquid known as the perilymph.

Anything causing sound vibrates and the air surrounding it is thrown into waves. These waves when they reach the ear we have the sensation of sound. Sound waves gathered by the outer ear pass along the auditory canal. They strike the tympanic membrane which vibrates. As a result, when this membrane is pushed in, the three bones move and the stirrup closes the oval window. Now the air current passes

upto the auditory area through cochlea and :we hear the sound.

The original air - vibration is transformed into a liquid-vibration in the cochlea before it is made into a sensation of sound.

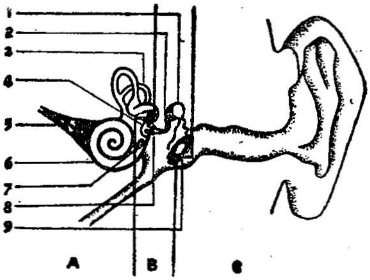


Figure 4.2. The structure of the human ear A. Inner ear B. Middle ear, C. Outer ear.
1. Hammer 2. Anvil 3. Vestibular organ 4. Oval window 5. Auditory nerve 6. Cochlea 7. Round window 8. Stirriup 9. Ear drum.

An Analysis of Sound: The stimulus which excites nerve cells and causes sound is longitudinal air vibration. When a vibrating body strikes the air, the particles about it vibrate backward and forward and successive waves are produced. These waves move in all directions until they come into contact with the ear or the receiver in a wireless set.

Sound is physically a wave motion and it travels at a speed of 1100 feet a second. Air waves which produce sound are different in three ways:

(a) in the rate of vibration,

(b) in amplitude and,

(c) in form or complexity.

(a) *The Rate of Vibration:* This is what is called pitch or tone. A tone which is a sequence of uniform vibrations may be high or low. A tone should be differentiated from noise, which is a combination of different types of vibrations. In short, a noise is composed of irregular sound waves. Pitch refers to the lowness or highness of a sound. Pitches range from the lowest notes produced by the longest waves to the highest, produced by the shortest waves. Thus difference of wave length of sound waves produces differences in the pitch.

(b) *Amplitude* : This is the distance through which the particles vibrate. This gives to a tone its loudness or intensity.

(c) *Form or Complexity :* This is called timbre. Difference of purity is caused by the mixture of different wave lengths in sound. Suppose the sensation is produced by a stimulus consisting of waves of the same length, we get a 'pure tone'. The difference between the different instruments is a difference in quality or purity of the tone. The characteristic quality of different instruments is called the Timbre. Suppose the same tune is played on a Veena and a Violin, we are able to notice a difference and this is because of Timbre.

Theories of Hearing

A theory of hearing should try to explain as to how exactly do the fibres in the basilar membrane catch the vibrations in the liquid around it.

(a) *Helmholtz Theory :* This theory is also called Piano string theory or place theory. In explaining it a parallel is drawn between the strings of a piano and the fibres of the basilar membrane. The wires in a piano resonate (vibrate) to external frequencies. Similarly the fibres of the basilar membrane resonate to external frequencies. The theory put forward by Helmholtz makes a claim that each region of the basilar membrane is particularly attuned to a certain frequency of vibration. When a tune or note is sung into the piano, a string in the piano can be thrown into sympathetic vibration. In a similar manner a fibre in the basilar membrane will be thrown into sympathetic vibration when waves reach it through outer and middle ear.

There are nearly 20,000 fibres or strings in the basilar membrane. The ordinary human ear can easily distinguish about 11,000 tones. So this is a possible theory and also a satisfactory one.

(b) *Ruherford's Frequency Theory :* The human ear functions like a telephone receiver according to this theory Each frequency is carried to the brain. The pitch is determined by the frequency of the nerve impulses reaching the brain. But loudness of a sound wave depends upon the number of auditory fibres activated.

(c) *The Volley Theory* : This is a modified frequency theory By themselves the two theories are not exhaustive. However when the two are combined we may get a satisfactory explanation.

The Chemical Senses

Smell and taste are called chemical senses. These two are activated by chemical substances. Many studies were not made on smell and taste. Therefore we don't get much information about these senses as seeing and hearing. The reason for non-availability of much imformation on these two is that it is very difficult to conduct experiments on smell and taste.

3. Taste

Taste is known as gustatory sensation. Generally we think that there are numerous tastes. Every kind of food is having a

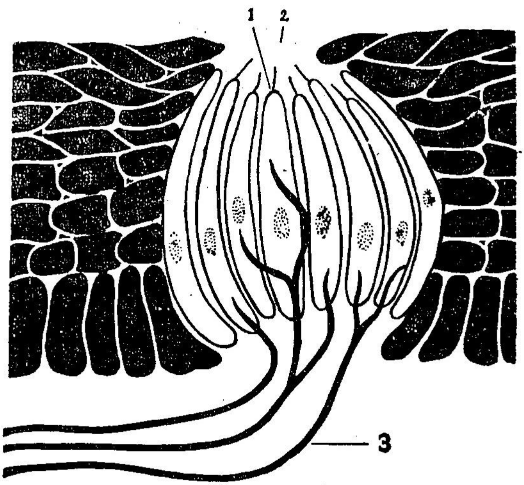


Figure 4.3 A diagram of a single taste bud
1. Taste cell 2. Taste pore 3. Taste neuron,

unique taste. Apart from tongue, the smell and touch sensations make us think like that. Scientific Research refers to only four elementary tastes like sweet, sour, bitter and salt. The other tastes are only compounds. The different sensations cannot be ocnnected with different parts of the tongue easily. But roughly

speaking sweetness is perceived on the tip, sourness on the sides, bitterness on the back and saltiness on both the tip and the sides of the tongue.

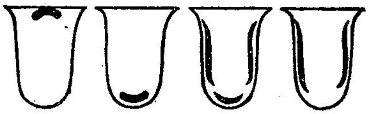


Figure 4.4. Location of the four basic tastes on the tongue.

1. Bitterness 2. Sweetness

3. Salt 4. Sour

The real organs of taste are the *taste buds* which lie underneath the surface of the tongue. So the taste-buds of the tongue are the receptors for the sense of taste. The tongue is full of countless pits. The tips of the sense cells run into the sides of these pits. We can taste liquids quickly. But solid food should be well dissolved in saliva to have taste sensations.

The different tastes which we commonly refer to are only compounds of taste smell, touch, temperature and muscle sensations. The flavour of coffee depends on smell. Temperature seems to modify taste considerably. As we all know that ice-cold Idli tastes different from hot Idli. Further taste differs according to the roughness or smoothness of the object. Sugar pulverized and unpulverized make a lot of difference in taste. Smell has more influence on taste than that of touch. Much of our delicate tastes are really smells which reach the nose through the air passages that link it with the mouth. A Strong cold, as we all know, destroys almost all of our taste sensations.

4. Smell

The sense of smell is also known as the olfactory sensation. What we know about this sensation is very little. The organ of smell is the olfactory membrane which is situated in the upper nasal cavity. According to experimental evidence there are six elementary smell sensations. They are the following :

(a) Spicy (pepper) as in cinnamon

(b) Fragrant (flowery) as in vanilla

(c) Ethereal (fruity-apple; orange etc.) as in ether

(d) Resinous (turpentine) as in turpentine.

(e) Putrid (Foul) as in hydrogen sulphide

(f) Burned (Scorched) as in tarry substances.

It is possible that different parts of the nasal membrane are connected with different types of smell. A person may lose his sensitivity to particular smells alone because of certain discased conditions. Even persons who have a normal sense of smell get tired (fatigued) by a certain smell, especially when they continue to smell it for a long time. As a result a period of insensitivity to that smell intervenes. For instance, after smelling camphor for a considerable length of time, alcohol will not be noticed at all. Just like taste sensations, the smell sensations usually get themselves mixed up with other sensations like tactual and taste. The sweet odour of chloroform is to a large degree a matter of taste.

Man's sense of smell is very poor compared to that of the dog. There has been a considerable deterioration of the olfactory capacity with the progress of evolution. The sense of small is useful for warning us aganist bad air and food.

5. The Skin Senses

A touch is actually made up of several different sensations These are called the cutaneous sensations. This is usually connected with touch or tactual sensations. But in reality, skin as a sensory receptor has four senses. each with a separate quality and different sense-organ. The four sensations of the skin are (A) Cold, (B) Warmth, (C) Pressure (touch) and (D) Pain. The sense-organs associated with these sensations are called spots. They are located below the outer surface of the skin. Any specified area of the skin contains all the four spots in different proportions. Suppose the skin is explored with suitable stimuli, they can all be located.

The appropriate stimulus for locating cold spots is a fairly cold needle. By passing over the marked area of the skin and which is also made hairless, point by point with a fairly cold needle, there will be felt an unmistakable sensation of cold. These points denote the cold spots. At other places there will

be no sensation at all. That means our stimulus has been contacting some other kind of spot and as such no response at all. Cold spots are easiest to be traced. To locate warmth spots is a little bit difficult since they lie deeper in the skin than the cold spots. The suitable stimulus for the warmth spots is a fairly hot needle.

The temperature of the skin varies at various places. The exposed parts of the body will be colder than the unexposed on a cold day. The temperature of a given portion of the skin, at a given time, is called the *physiological zero point.* The temperature of the warmth stimulus should be above the physiological zero point in order to be effective.

Generally, a cold spot is responsive to only cold stimuli and similarly a warmth spot to hot stimuli. But sometimes a cold spot is put into activity by a warm or hot stimulus. When this happens, the resulting sensation is cold but not warmth. This is called a *paradoxical cold sensation.* When a cold stimulus arouses a warmth spot, the person will experience a warmth sensation, This is called a *paradoxical warmth sensation.*

Pressure spots are more in number than cold or warmth spots. But they are less than pain spots. To locate them, the skin should be explored by a horse-hair or bristle. Pressure spots are distributed over the whole surface of the body. The pressure exerted on the skin when it become too much, the resulting sensation will be pain but not pressure.

The pain spots lie deep down in the skin. If a pain spot is to be thrown into activity, the appropriate stimulus-a sharp pin-should go deep into the skin. This is a protective device. Suppose the pain spots are located in the outer surface of the skin, we will be perpetually alarmed by the danger of pain. Pain spots are very sensitive and they give us a warning of dangers to the body.

The Body Senses

All the internal senses are called body senses. They are the organic senses, kinesthesis and vestibular sense. They mainly help us to maintain inner homeostasis and balance as we walk and stand.

6. **Organic sensations**

Sensations from the internal organs like hunger and thirst are called organic sensations. Hunger originates in the membranes of the stomach while thirst in the back of the mouth, very near the throat. Hunger is a sensation aroused by the contraction of the stomach walls. The low water position in the human organism and the consequent dryness of the throat and mouth give rise to the sensation of thirst. There may be special organs to inform us about disturbances in the respiratory and circulatory systems but at the moment we have very little knowledge about them

7. **Kinesthesis**

This sense gives us information about the position and movement of our limbs. Further it enables us to know the difference in the weight of several objects by lifting them with our hands. This sensation is different from a skin sensation. Kinesthetic sensation has been found in people who have lost the skin sensation and so it is more than a skin sensation. Suppose the judging of weight is purely a matter of pressure, then we should be able to remark, immediately we lift an object, how heavy it is. But in reality we are not able to do so, unless we resort to move our hand up and down several times. So it is reasonable to suppose that we have a special equipment to find out movement and weight over and above the help offered by touch sensation. This special equipment is known as the kinesthetic sense.

This sensation originates in the muscle spindles embedded in the muscles of the body; the tendons and the joints in general. The sensation of kinesthetic type can be well illustrated by the following example. Suppose the arm is bent double there is a contraction of one set of muscles and a relaxation of another set. The muscle spindles in one set of muscles will be actually contracted but in another set they will be just relaxed. As a result, sensations coming from these muscle spindles enable us to know the exact position of our limbs, even if our eyes are closed or blind folded.

8. The Vestibular sense

The vestibular sense is very important in birds and fish to orientation. They relay on it to tell them which way is up and in what direction they are going while flying and swimming. In man this system supplies information about body position and movement.

The three semi-circular canals in the inner ear are responsible for this sensation of equilibrium or balance. These canals are filled with a liquid or fluid. Every movement of the head or body has a corresponding effect on the fluid in the canals. Hairs project in the liquid of the canal. If the liquid is disturbed the hairs are moved. As a result they set in motion impulses which are carried by the nerves connected with them to the motor area of the brain that controls the movements of the body. Later suitable adjustments are made to restore the equilibrium of the body. When a person sits in 'merry go-round, or involves in 'Thattamalai' by swift rotation, the semi-circular canals are affected and the person complains about motion sickness and giddiness. Suppose the semi-circular canals are injured a person automatically loses his sense of balance and proper motor adjustments become impossible.

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CHAPTER-V

ATTENTION

Introduction

The sense organs receive informations from the external world in the form of stimuli and convert them into meaning materials. For example, seeing, hearing, tasting, smelling, touching of the objects, persons, places and other events of life provide essential informations. An individual must deal with his environment successfully, for which our senses are the guiding elements. Woodworth, the famous American Psychologist considers that observation is the single concept that would explain the whole processes. According to him observation is a topic of central importance in the whole field of psychology. Observation, he says, has two steps, one is attention and the other is perception. Attention is the preliminary step for observation and perception is the final step. Here we shall deal with attention.

Attention

Attention may mean the action, fact or state of giving heed. It is the earnest direction of the mind. It is the stage of mind which prepares us to receive impressions. Attention is a cautionary word used as a preparatory to any particular exercise. It is giving a watchful heed to the wishes of others or to something out side of us. When the physical director says, "attention", he means that you are expected to be ready for some task which he is going to give next. Your lecturer often may say "Attention please". He means, "please listen to what I am going to speak to you". Attention is the first step in the perceptual process.

Attention is defined in several ways. It is defined as a set or readiness to respond in a certain way. According to Murphy, it is a narrowing of the range of objects to which the organism

is responding. Krech and Crutchfield : Attention is the focussing of perception involving a hightened awareness of a limited part of the perceptual field.

Teichner says that the alert organism attends to some stimuli but not to others. The state of attention implies not only activiation of some parts of the behaviour but inhibition of others, This process is called tuning. In the process of attention an important characteristics of an organism is its bandwidth or narrowness of the range of stimuli to which it will respond. The narrow attentional bandwidth increases sensitivity and selectivity of additional processes. The organism pays closer attention to a narrow stimulus field. Therefore, we can define attention as the process of narrow downing the perceptual area by selecting any one of the stimuli at a given moment and ignoring others.

Focus of attention

Many events may be taking place around us. But it is not possible for us to pay equal importance to all of them. We give importance only to a single stimulus or event out of many. Therefore, we select one object or event and attend to it. This process is called focussing. You might have heard or used this word 'focus', when you sit for a photograph or use a camera. What the camera man does is,focussing the lens on the person or the group. Similarly in a drama or Play house you might have observed that the bright or colour lights are turned to the direction where the hero is playing his part. This we call, focussing the light. In the same manner we focus our attention on a particular object or act. Sometimes you may be watching several interesting events and may be desiring to see all, of them or more than two. But your power of attention is limited and you are forced to see only one at a time.

Factors of attention

Attention is based upon the nature or properties of the stimuli. In the applied areas advertising men make use of this technique to attract the consumer's attention and arouse their desires to buy the particular brand of article. There are two kinds of factors that are accounted as determinerts. They are

objective factors and subjective factors. If the advertising technique is to have any effect upon the consumers both the factors must be involved.

Objective factors

The important objective factors are : 1. Size, 2. Intensity, 3. Motion or change, 4. Novelty or striking quality, 5. Repetition, 6. Duration, 7. Contrast or difference.

1. *Size :* Stimuli in the perceptual field may be having different sizes. Our attention depends upon the sizes of the stimuli. Therefore, a stimulus which is large in size is more likely to attract our attention than a smaller one. This is what we find even in society. A tall and stout man can easily take the advantage of his size in commanding others. A big capital letter. a full size advertisement a big size portrait can catch the attention of the people much better than smaller ones. Further the respondent will have no difficulty in perceiving the bigger objects, whereas he has to take pains to see smaller objects. A mountain is seen even from miles far off but a man in the same mountain is not seen. Therefore, the size of the stimulus field is a strong determining factor of our attention.

2. *Intensity* : This refers to the quality of the object. The stimulus has certain strength to attract the organism. A strong stimulus is better noticed than a weak one and receives better attention. For example, a bright light draws our attention at once, whereas a dim light fails to do it. Similarly, a loud noise, a strong smell would attract our attention much better than weaker ones. A much painful incident is more seriously attended to than a painless incident. The phenomena of intensity of the stimulus is directly related to the various degrees of sensory reactions.

3. *Motion or change :* Motion is an effective psychological factor used by advertisers. A moving object in our field of vision will catch our attention much better than a static one. Even when our attention is not focussed in a direction a rapidly moving object would draw our attention in that direction. For example, a fastly driven motor car is seen at once by us whereas

a parked one is ignored. Many advertising sign boards make the letters and objects keep on moving constantly to attract the consumers. Some of them are devised with blinking lights. In big cities while walking through the shopping centres we could not avoid such advertisements.

4. *Novelty or striking quality :* The degree of novelty of an object is having a definite effect upon the organism like motion or change. An object in a familiar place will not draw our attention. But an object in an unfamiliar place or a man in unfamiliar seat is in a better position to attract us. For example, a police man in black uniform or a student in police uniform in the class room is not likely to be overlooked. In the fancy dress competition one who outfits others in unfamiliarity gets the first prize. An unusual colour combination, an unconventional picture, an unfamilar sound are some of the objects compelling our attention.

5. *Repetition* : Stimuli that are presented intermittently are having more effect than those presented continuously. This principle is applied in several situations. When caution is required or warning is given repetition of the stimulus is made by electric display signs in many places. The display signs flash on and off. If the danger signal is presented once or in a non-stopping manner people may not look at it. Therefore, the stimulus is repeatedly presented. The repeated stimulus increases our power of sensitivity or awareness.

6. *Duration* : A stimulus must have a minimum duration of time. Otherwise it will not have any effect. The duration depends upon the intensity of the stimulus. If the intensity is stronger the duration may be shorter. A weak stimulus requires longer duration to arouse our attention. For example, a very short time, that is a fraction of the second is sufficient for a bright light to arouse our attention, but a faint light requires more time to do the same. The Bunsen-Roscoe law explains the relationship between intensity of the stimulus and duration in mathematical equation. But if the stimulus is having very long duration it loses its effect because it is present continuously. This principle is applied in the harbour light-houses.

7. *Contrast or Difference :* A stimulus that is contrast or different to the background is very effective. One aspect of the environment must stand out completely from the reminder. Architects, modern decorators use this idea in building, painting, decoration and furnishings to beautify the area. They say that there must be contrast or striking difference between objects, qualities and colours to show their relative excellence. In an area if all the buildings are skyscrapers and if one is very short, it is a contrast to others and it draws our curiosity and attention In military the soldiers camouflage everything that is in contrast to the background. That is, they conceal an object by reducing the contrasting quality between it and the background. Otherwise the enemy planes will easily find out the location where to bomb and destroy.

Subjective factors

There are certain factors in attention which are based upon the individual characteristics. They are called subjective factors. These factors originate in the previous learning and experience and in the individual's motivation and interest. They are 1. motivation, 2. previous experience, 3. perceptual set.

1. *Motivation* : We are having several needs. These needs are to be fulfilled, towards which our attention is directed. But all our needs are not having the same amount of strength. Time makes us to forget several things. At times certain needs or motives are becoming strong and when we satisfy the needs they become weak and disappear. When we are hungry our needs are strong for some kind of food. Such physiological needs are strong for us at times and when they are fulfilled we ignore them. Therefore, motivation generally refers to the behaviour instigated by needs and directed towards some goals. It is something that propels action originating from within the person who acts.

If the motivation is weak we tend to respond to variety of stimuli, and we don't see the relevance. If the motive is strong we respond to certain particular stimulus and not going into the details that are not connected to the motive. Advertisers

often make use of sex drives in their advertisements to draw the attention of the consumers. They present in their advertisements something related for the consumer's sex drive which makes them to be attentive. Modern advertisements, whether they are related to men's wear or women's wear, a soap or hair oil are associated with sex, because sex could draw the attention of the people very easily.

Similarly, if two persons are walking along the country road side one who is a botanist, is interested in plants and the other who is a zoologist, is interested in animals and birds. Every one is interested in different matters. If you ask the botanist anything about the characteristics of species of animals and birds he would say that he does not know them. So also the zoologist may not be knowing about the plant life. The motives of these two persons are strong because they tend to respond to a restricted area and not interested in other parts of the environment that are not related to their motivation. A strong motivated person is attracted to more informations in a narrow area whereas a weakly motivated person is attracted by many things around him but know little about a particular object.

2. *Previous experience:* Every one of us is having some previous experience in something. In certain things our experience is very wider and in certain things it is very narrow. This experience determines our selection of stimuli from an environment. The accuracy of our perceptual process is, therefore, based upon the nature of experience we have acquired in the particular object or event. For example, a deep blue sea is looked upon differently by different people. An oceanographer is interested in finding out the depth of the sea, while a sailor looks upon it as a wild sea to cross it over. A fisherman may look upon it as the source of big catches. A marine biologist may search for a new species in it. The deep blue sea attracts the attention of all these people, but every one sees it with his past experience. The process of selection is in operation here.

The selecting tendency of the individual filters out certain aspects of the environment from his past experience. But if certain aspects are relevant to guide his behaviour and if they

are filtered out it may impair his learning ability. This selecting tendency would improve the performance of the individual in a situation if irrelevant aspeet of the stimuli are neglected and relevant things are responded. We are always trying to project our past experience in every perceptual field. Sometimes it may result in certain disadvantages. The personal biases may interfere at certain stage of our past experience and we may even change our perceptual field. This selecting tendency is called by some as personal habitual interest.

3. *Perceptual set :* Set is playing an important role in the selection of our perceptual stimulus. Set is also called expectancy and momentary interest. Set is closely related to previous experience. According to Morgan a set is a readiness to react in a certain way when confronted with a problem or stimulus situation. Therefore, set means a tendency to respond in a certain way. It is established by events.

The effects of set are short lived. In set we make ourselves ready to respond to certain stimulus that we have been expecting. The set is purely individual or personal in nature. What is a set to one person is not a set to another person. For example, you want to wake up at 4 O' clock in the morning and you set your alarm clock at 4 A.M. When the alarm clock rings at 4 A M. you immediately wake up. Whereas your friend who is sleeping in the same room is not waking up. Even if he is not sleeping he does not wake up. Because you set yourself to wake up at 4 A.M. and the alarm is for you and not for your friend.

A sprinter, who is taking part in the race is ready to start at the crack of the gun shot. The sleeping mother wakes up immediately at the cry of her child, whereas her husband who is accustomed to telephone calls wakes up when the phone rings All these people have set themselves to respond to some particular stimuli. Therefore, the term set is referred to the readiness of an organism to pay attention to certain perceptual object or stimulus pattern. A set can be created in an organism by training. An organism is allowed to eat a particular kind of food at a particular time for few days. Naturally he learns to respond in the specific pattern to satisfy his needs. Here a

set is created in the organism. Pavlov has created this kind of set in his experimental animals.

Some scholars are of the view that set leads to increase the efficiency in behaviour. But it is not so. It is not increasing the general efficiency in behaviour. The increase of efficiency in behaviour is limited to the particular stimulus situation to which we have set ourselves. We could observe this in certain situations. When we are set to one aspect of the situation we are not prepared to respond to another aspect of the same situation even if it is more important. For example, when you are searching for a lost silver coin, a golden coin on the same ground is not noticed by you. Because you have set yourself to find out only the silver coin and not the golden coin. Previous experience and set may cause the same result even though they are not the same. Previous experience requires more duration to establish whereas set is short lived, occurs for momentary act and may also be shifted.

Division of Attention

Our attention is normally directed to one object at a time. Sometim es it so happens that we try to attend to more than one or two things at the same time. But our attention will have only one form at a given time. Due to certain necessity or inattentiveness to one object we often divide our attention and distribute it among different objects or attend to different activities. When our attention is distributed over the whole field of consciousness there may be greater concentration at one object or activity and less concentration on the rest. Our attention, therefore, is diffused and no particular object or activity is dominent. Therefore, division of attention means, trying to attend to two or more objects or activities simultaneously. The Indian mystics often speak about 'astavatnanam' which means, attending to eight activities simultaneously. It is said that Napoleon was capable of writing two different matters with two hands simultaneously. But all these things were not experimentally verified. Woodworth says that division of attention means a simultaneous focussing upon two separate activities. According to him if one of these is automatic, it goes well without conscious control. Then there is no division of attention.

There is no doubt that we are all engaged in more than one activities simultaneously. We are walking fast on the road and speaking with our friends, seeing things around us, rolling the walking stick and smoking the cigar. Are these not simultaneous activities? But, are these activities independent or interdependent ? These activities are interdependent and therefore do not satisfy the conditions of the definitions.

Psychologists have been trying to study this aspect of attention experimentally, Paulhan was able to do two separate activities simultaneously. While reciting a famous poem orally he was also writing another poem. Further he was able to do a simple multiplication and also recite a poem. Both were done without any interruption. Binet as early as 1890 has conducted experiments on division of attention. In psychological laboratories there are several kinds of experiments designed for this. One familiar apparatus is the Division of attention board.

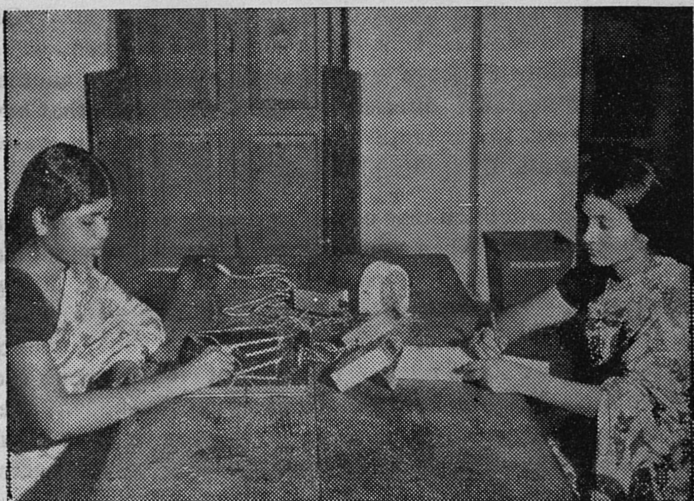


Fig. 5.1 Division of Attention Test.

The apparatus is a board, having two different patterns and electrically operated. The two patterns are connected to two electric counters and two styluses. The subject is asked to run

the pattern with the stylus as fast as possible with right hand and then with left hand and thirdly with both hands simultaneously. The counter records the number of rotations the subject has made at each occasion. It is assumed that the number of rotation made by both hands must be less than the number of rotation made separately by right and left hands. In this way the percentage of loss of efficiency in each hand can be determined. This loss is due to the divided attention.

Different pattern of experiments can also be designed. Two mental tasks simultaneously may be assigned or one mental task and one physical task or two physical tasks may be assigned. The efficiency of double performances is determined by finding out the percentages of the performance of the two tasks.

Shifting of Attention

Attention once focussed on an object or event may be shifted very easily and quickly. Individuals concentrating their attention on something do not continue it for long time. Our attention often moves like a movie or television camera. It centres first on the object or event and then moves to another. Our attention is always directed to objects or events that have strong attractions to our sense organs. This process is called shifting of attention.

Shifting of attention may occur very easily while looking at ambiguous figures. When you look at a person, what is that you are looking at him ? First you look at his face, then go on shifting from one place to another. The face as a whole, then eyes, nose, mouth etc. After few seconds your attention replaces the objects as a relief. You do not see a person's eyes all the times. You also look at other parts of his body. Then you may look through the window. When you fix your attention on a picture or person or an object your eyes may be going on shifting from one view to another in accordance with the intensity of the stimulus. There is change of position or direction in your attention. The change or shift may be voluntary or involuntary.

The shift of visual attention may be measured objectively. We can record a person's successive eye movements when he

is looking at an object. We shift our attention for several reasons. In attention there is form of satiation. This makes us to inhibit the continuence of our attention in a place or direction. In the total perceptual process the shifting of attention is an essential process.

Shift and Fluctuation : These two process appear to be the same. But they are two processes. They can be differentiated, and related. Our attention has two kinds of processes. It shifts from one response to another and secondly it fluctuates in the efficiency of response. Our attention often fluctuates from its original position. Just like the waves rise and fall our attention also makes repeated variations in its intensity. We do not pay the same amount of interest at an object we see.

Fluctuation is lapsing from a high level of efficiency during continuous work. The responses change but the stimulus remains the same. For example, when we look at certain event or object we do not put the same amount of attention on it all the times. In the beginning, it is very strong, we have more amount of curiosity. Later on it slowly decreases and diminishes. We may even withdraw from it for few seconds and go back to it. If the motivation is strong in attention there would be no fluctuation. But attending to an object with same amount of curiosity is not possible. There may be vacillation in attention.

Modern psychologists are of the view that there is no difference between shifting of attention and fluctuation of attention. Therefore, they do not give different treatments to these two processes But it is possible to differentiate these two to some extent. In shifting of attention we withdraw our attention after a few seconds from an object and move to another object. But in fluctuation of attention, we do not withdraw our attention from the object. We fail to attend to it with the same amount of strength. It is strengthening and weakening the process of attention.

The span of attention

There is certain amount of limitation in our process of attention. We cannot see everything and anything at one glance

or look. Therefore there is a limit for our attention. It is called span of attention. It is just like an individual clearing a pole-volt or high jump or long jump. He has capacity to clear a certain height or length. For example, an athelete can run 100 meters in 9 seconds Similarly there is a limit in our attention to see a number of objects in a single act of perception.

Psychologists have devised certain apparatus to measure our span of attention. Tachistoscope is the apparatus generally used for this purpose. Cattell has invented this. Now-a-days we can see various patterns of tachistoscope in psychological laboratories. It is a board held vertically with a window at the centre. There are cards designed for this purpose with dots varying in number ranging from 5 to 8.

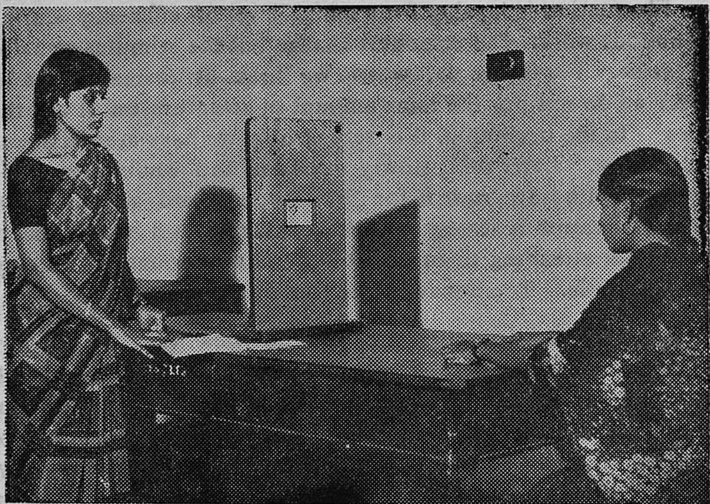


Fig. 5.2 Span of Attention Test (Tachistoscope).

The card is kept in the pocket of the shutter at the backside of the board and the shutter is held by a lever at the top of the board. The subject is asked to watch at the window. When the shutter is released from the lever by the experimenter the shutter falls through the window exposing the dots in the card for a fraction of a second. The subject is expected to say how

many dots he saw in the card. The cards are presented at a random order. Every time when the card is presented to the subject through the window the number of dots may be varying. The maximum number of dots, the subject could discriminate clearly in the card, is his span of attention. The span of attention of a subject can be five, six or seven. It varies from person to person depending upon the person's power discrimination of the dots in a fraction of a second.

It has been concluded from experiments that the span attention for a normal human being is three letters and four numbers. Anything beyond this limit will result in errors. If the letters and numbers are more than this in any situation, there will be more error responses than correct responses. This psychological idea is applied mostly in giving numbers to vehicles, You might have seen a vehicle either a motor car or bus or lorry having only three letters and four numbers. This is the normal human span of attention. The letters and numbers are presented like this : TMX 8116, TMY 7812, TMZ 9999. The three letters are not non-sense syllable. They indicate the State and the District and the numbers indicate the serial registration number of the vehicle. There are two groups of stimuli here, one the letters and the other the numbers, It is easy for our mental faculty to organise the perceptual field into units of letters and numbers.

There may be also arrangements to have more than two groups as three or four or five. For example, we may have there groups and four units like this with twelve dots.

* *   * *   * *

* *   * *   * *

When we have more than one group with four units or five units the groups must be presented in the card in some order. Otherwise it will not be possible for the subject to distinguish the number of groups and to organise the perceptual field into units. It is important that all the groups must have the same number of units. Whether a group consists of four or five units (dots) the same principle must be followed. The groups must be placed with sufficient interval of space. When this kind of complex units are presented it is better to have a wider window

in the board. The span attention in this complex type of units is only four and not twelve.

The number twelve is given by calculation. This kind of experiment is conducted with visual stimuli. In the same manner we can also design experiments to measure the span of attention with auditory stimuli. Sound is caused by rapid tapping and the subject has to tell the number of taps he heard and this becomes his span of attention.

The Distraction of Attention

The distraction of attention refers to the failure of concentration of attention. Every body is interested in focussing his attention on certain object. Particularly in the field of education the failure of concentration causes much anxiety to the teachers and parents. Why, the student himself is much worried about it at the time of examination.

Our attention is not pinned up to the object or activity as we desire to be. Because there are some forces that are impairing our performances and turn our attention from the perceptual field This process is called distraction. The forces that are impairing our activity are called irrelevant stimuli or distractors. It is possible to verify whether there are any forces called distractors in our attention. A distractor is one that interferes in the efficiency of the performance. This does not mean that performance itself is affected. We can experience and find out the intereferences in our various performances. In mental and physical works we ordinarily experience interferences.

Students often complaint that they could not concentrate their attention in their studies owing to the constant disturbances caused by the noises outside. Some say that they could not study because there are four or five students in the room and they are always engaged in some kind of talks. Still some might say that the light is very dim and few may have the complaint of constant stomach pain. So there are several sources of distractions in our attention. The sources of distraction may be external like sounds or noises, moving visual objects, insufficient light, internal sources like stomach pains headaches and mental sources like interferences of ideas.

When there are loud noises outside how can we concentrate on our studies ? Noise is an irritating and unwanted force. Noise is an irregular sound. We don't like it. If noise is regular it becomes music and we like it. But we don't want it at the time of our study. In some kind of works noise is required because it increases efficiency. For example, in spinning mills it is required. The typist who is accustomed to the clattering noise feels that the absence of noise is a source of distraction for him.

If there is any moving of objects or persons constantly we may feel irritated at the time of study. Similarly when the student is having severe stomach pains how can he concentrate his attention on his lessons. Several ideas may be appearing in a chain like manner in our mind. You may stop studying your lessons and go into world of imagination. Therefore, distractions are functioning in these manners to destroy our concentration of attention. Woodworth says that anger is the worst distracting force than noise.

Experimental results suggest that the effects of distractions are not so severe as they are thought to be. An experiment has been designed by Horey to study the effect of distractions. One form of the Army Alpha intelligence test was administered on a group of college students. Then the group was divided into two on the basis of the scores. One was the control group and the other experimental group. Six weeks later another form of the Army Alpha test was administered on the control group under normal conditions and on the experimental group under conditions of distractions. There were lot of distracting forces like loud noises of different types and bright lights etc , on the experimental group. But the scores of the second test were not much affected.

In the first test both the groups had equal scores. In the second test though the control group scored little higher than the experimental group the difference between them was only 3.7. The distracting forces did not cause appreciable difference. Therefore, it is inferred that the type of attitude the individual has developed towards the forces of distraction determines

the results. If one believes that music is accelerating the efficiency in performance he is sure to make gains and loss if he holds the opposite view.

Overcoming distraction : Since distraction is an undesirable experience we are trying to avoid it. Therefore, we have been constantly searching for suitable methods to overcome it. Psychologists were able to suggest some methods.

One way of overcoming this distracting force is to put more energy into the performance. You can put your face into the book and start reading the passage loudly. On one of the experiments conducted on a typist it was found that noise had little effect in the performance in the beginning, but later on the effect disappeared when the typist put more effort in his work. In overcoming the distraction the subject put increased muscular energy. It is instinctive to put some additional energy into the activity if there is any distraction. If the work is continued for many days with some distractions there will be greater out put in the work without putting extra energy into the work. The individual has learned to do the work inspite of the distraction. It is called negative adaption. He has learned to ignore it. This is supposed to be another method of overcoming the distractions.

There are certain distractions that we could not avoid or overcome them. Further some distractors have disturbing back-ground more or less. Sometimes the distractors themselves become centre of interest and the observer forgets his work. Woodworth says that the background of music which was a source of disturbance for the work later on became a source of facilitation for the same work. This process takes place when we could not overcome the distractions.

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CHAPTER VI

PERCEPTION

Man is surrounded by multitude of stimuli or forces. He, either converts them into some kind of knowledge for his use or avoid them if they are dangerous. While discussing about sensation we have stated that stimuli from the external world are attacking the organism in various forms and the organism is responding to them with its specialized senses. In attention we have stated that there are several stimuli in the external world. We select and attend to a particular stimulus. But here we are coming across a complex process which is a synthesis of these two and several others. This process is called perception A man must know that there is an object outside of him at a given distance in a particular direction with certain characteristics which are important for him. Varieties of stimuli come in complex form and stimulate us. However complex they are, we are able to organize them in some way automatically and we are able to describe what they are. How this process of organization is taking place within us to give the correct meaning to the objects ? This is the subject matter of perception.

What is perception ?

Perception involves responding to the world through our senses. It is not a total response to everything outside with all our senses simultaneously. The response is some specific and serves some purpose on the particular occasion. Therefore, our response is selective, purposive and relevant to our needs. We select and organize, those things which are needed for our purpose and leave the rest as the background of our perceptual field. According to Moskowitz and Orgel perception is a wide-range response to a stimulus or set of stimuli which integrates the information beyond that stimulus contains. The meanings of other stimuli obtained from past experiences may also be added to this.

Wickens and Meyer defined perception as a process which gives significance to the stimuli making the perceiver to react to the event in an adaptive manner. Murphy says that perception is a way of coming in terms with the environment playing certain features up and down. He emphasises four different aspects in perception such as similarity, quality, past experience and set. According to Stagner and Karwoski perception is the process of obtaining knowledge of external objects and events by means of senses.

Man makes use of his sensations and arrives at certain conclusions about the objects and events of the world. If the objects and events are real and well established he does not doubt his knowledge too much. But still while dealing with physical objects he resorts to probability for accurate knowledge. The physical objects and events may be new and unfamiliar and also not well established and they are further away from him. In such cases his knowledge is subjected to verification as chances of error are Possible in it.

Let us assume that a man from a remote village, where there were no trains, motor cars, buses, electricity, industries, big buildings, sea etc., was brought suddenly into a big city like Madras. Under such new situation what he would look at ? He would be in a stage of buzzing. There are innumerable number of colours, contours, shapes, brightness. The person is visually stimulated with many new objects. He is not able to identify objects. Eventhough he could make use of them, and knows the language, he is not in a position to answer any questions relating to the objects. We must see, use and handle the objects and learn to answer any questions related to the objects. It is easy for such persons and children to name colours. In case of size, distance and motion they must acquire knowledge. But it requires longer time for them to identify shapes. William James said that the child's world is a big booming, buzzing, confusion.

Perception takes place when a part of the stimulus is used to predict the presence of the total stimulus situation. In other words, it is like the prediction of the object flower or dinner from the smell without seeing it.

In our every-day life, we are making several perceptual reactions to things and events. When dark clouds are collected in the sky and cold wind blows we understand that there is going to be rains and immediately run for shelter. You are waiting for a train and the railway bell is ringing, you make all the preparations to get into the compartment thinking that the train is arriving at a distance. In all these incidents we are combining several things in our perceptual process. Perception reduces chances of our failure to achieve something and simplifies our life process and make our adjustment more easy and effective. Therefore, perception may also be defined as the process of knowing the objects and events in the external world through our senses and making them a meaningful whole with the help of past experience and learning.

Perception and Sensation

While explaining perception we have been using the concepts senses and sensation. This naturally infers that there is relationship between perception and sensation. Sensation is a response to specific stimulus such as visual auditory etc, Perception is a response not only to the specific stimulus, but to the whole situation. Perception relates our behaviour to a complex pattern of stimuli. Sensation refers to the function of sense organs with their nerves and nerve centres. Perception refers to the objects of the world known through the sense organs.

For example, in an experiment on sensation we present a simple stimulus to an observer and try to measure what reaction the stimulus has aroused in the observer. In an experiment on perception we present objects to the observer and find out how well they are observed by the observer. The observer is attentive to what is presented in both sensation and perception and the responses in both cases are also verbal. In sensation we are interested in relating the verbal report to the stimulus whereas in perception we relate the report with some facts.

Organisation of perception

In perceptual process the organism is reacting to certain stimuli and not to all in a complex environmental situation.

The stimuli are of various kinds. They may be having different shapes, forms, sizes and colours. They may be square, curved and angle. The stimuli may sound with high or low intensity and the sound may be intermitten or continuous. There may be also many stimuli of various kinds reaching our senses at the same time. All these types of stimuli are responded by the organism in the appropriate manner. There is no confusion or buzzing in our sensory process. In spite of innumerable number of stimuli and welter of stimulations things emerge with organized pattern. This organized pattern becomes basis for our appropriate reaction to the situation.

The gestalt psychologists were very much interested in the study of perception. They tried to determine how sensory impressions are organized. They have established that the whole is more than the sum of its parts. That is, a perception is more than the sum of a number of sensations. There is a tendency in the individual to follow certain basic principle to organize the sensations.

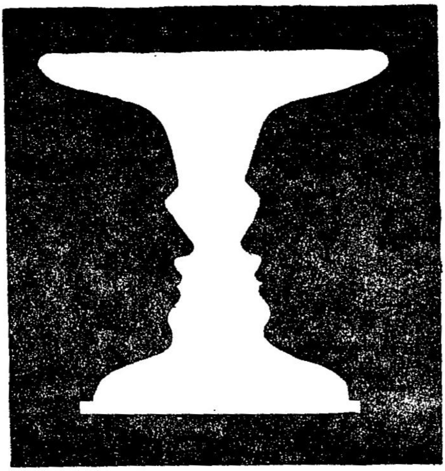


Fig. 6.1 Reversible figure-ground drawings.

Figure-ground : The figure-ground perception is the fundamental principle in the organization of sensations. It is the most primitive process in perception. The separation of

figure from the ground is basic in every perceptual process. This perceptual process is a development in the organism independent of practice or training. It is found in human beings. Persons who were blind throughout their lives organized their perception into figure-ground relationship without any experience. They did the organization spontaneously.

The figure-ground perception is also fundamental in another way. When we look at a stimulus pattern the figure-ground relationship emerges first before all other aspects are perceived. This has been experimentally tested by a projection tachistoscope. In visual perception a figure is often differentiated from the background by its quality such as shape, size, colour etc. The object appears closer and the ground recedes to a distance. A colourfully printed book on a table stands out as a distinct figure against the black sun glassed table top. The figure-ground relationship is not limited to visual perception. In the auditory sensory area the sound of a violin may stand against that of a symphony.

Closure : This is a tendency in our perceptual process to see things as a whole. When we receive sensations of an object in an incomplete form we try to see it complete. The incompleteness of the object is overlooked and the figure or object is perceived as a completed one. The term closure refers to the tendency to fill in the gap in the stimulus presented to us.

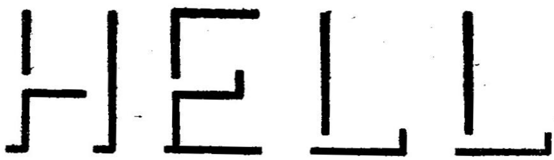


Fig. 6-2 Closure

Continuity : We like to see that elements should go with other elements in such a way that thay have continuity of a line, curve or a movement in the same direction. But the principle of continuity sometimes may lead to inaccurate perception.

Proximity : The perceptual organization occurs when objects are put close to each together. We don't perceive them as

separate objects. The individual items may vary to some extent. Still we group them in a single pattern. Proximity may be temporal or spatial. When a cracker is fired in a dark place we see bright light and loud noise. We tend to perceive them as parts of the same element. But if the light is seen after few minutes or sound is heard after few minutes we treat them as separate elements.

Similarity : Stimuli that are more similar to each other will have greater chance to be grouped. Similarity means that the object may resemble each other in several respects such as physical attributes, size, shape, colour, intensity, weight and odour etc.

Perception of space

The world in which we live and which we perceive is spatial in character. It is a three dimensional space and we cannot

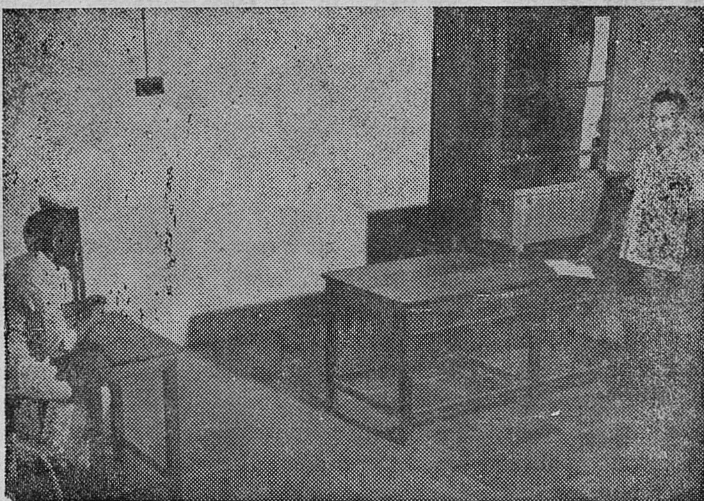


Fig. 6-3 Depth Perception Apparatus.

imagine or think of a world without a three dimension. When we look around us we see objects in three dimensions. The three dimensions are height, width and depth. We perceive an object

the three dimensional room. The room has a floor, the walls of the sides and the space in between the side walls. Similarly an object has three dimensions like length, width and thickness. Mans' biological make up is such that the retina of his eyes has two dimensions, height and width and no depth.

A person is facing certain situations constantly, in which he has to judge the distance between himself and the objects. When we walk through the streets filled with people the perception of distance helps us to avoid dashing against other people or carts or motor cars or other fast moving vehicles.

If we want to pick up a coin from the floor we judge the distance automatically and stretch or extend our arm. Running trains stop at railway station platforms without any errors. Aeroplanes from sky land in airports without any deviation, buses halt at bus stops without any failure, the paper boy adjusts his cycling in such a way that he never fails to drop the paper at our door-step. In all these instances persons involved make judgment of distances accurately. Every day we may be doing some judgments regarding the depth of the objects. How deep the well is? How much the barrel can hold? Can we explain the processes involved in all these?

When we look at two objects as at different distances, the images of the objects do not fall on the retina, one behind the other. Because the retina is flat the image of the farther object can be either on the left or right, below or above of another object. Our visual images are having only two dimensions. Therefore, a three dimensional world is a puzzle for us. How it occurs? The two dimensional images that fall on the retina area are converted into three dimensional perceptions. The two dimensions provide stimulus informations to evoke a third dimension. This is depth perception or distance. The informations fall under two sets. One is related to the environments and the other is related to the organism.

1. The Environmental Cues

The environmental cues are monocular cues, superposition, perceptive, light and shadow, movement and texture gradient.

Monocular cues : The informations received from the objects by using one eye are called monocular cues. We can make accurate judgments about distance and depth with two eyes. But our monocular cues often help us to judge distance and depth successfully. We cannot aim certain things accurately with our both eyes. For example, in shooting, we aim with one eye only.

Superposition : If two objects are on the same line of our vision and one is superimposed on the second, it partially blocks the distant one. The first one is nearer to us and the second is farther away. We could also see that the nearer objects are continuous and unbroken and distant objects appear broken by the nearer objects.

Perspective : It is a technical word used in painting and drawing in the estimation of distance and depth. Artists have found out that they can indicate the distant object and nearer object in their paintings. The nearer object is painted as larger and the distant one smaller. This is the way the artists evoke the depth perception in the perceiver.

Two lines that run parallel to each other may appear to come together at a point on the horizon. These converging lines are providing informations important to the aeroplane pilot. The pilot could understand the length of the runway which he is going to take. These cues to distance and depth are called linear perspective.

Distant buildings, objects appear hazier and less clear, whereas nearby objects look clear and bright. This is called aerial perspective.

Light and Shadow : Shadow is an important cue in depth perception. If the shadow appears on the parts of the object it is farther away. A two dimensional drawing may have a three dimensional look if lights and shadows are distributed appropriately. By this method a geometrical figure may give an appearance of a solid matter. A circle drawn on a paper may look like a flat disk. But if you give appropriate shadows on the

edges it would look like a ball. The shadow gives a different look to an object.

Texture gradient : The texture of the object provides certain cues to our perceptual process. The nearer objects appear rough irregular and full of dusts while the distant objects appear smooth, regular and clear. For example roads, houses and lawns have these characteristics.

Movement : The speed and direction of the object as it moves in the space works as a cue to perceive distance. While you are travelling on trains and buses you might have often observed through the window that objects like trees and telegraphic posts close to the railway lines and roadside are running fast in the opposite direction and the distant objects are slowly moving with you.

2. Organismic cues

The organismic cues are binocular cues, accommodation, retinal disparity and convergence.

Binocular cues : In the perceptual process two eyes may have certain advantages. Two eyes provide wider visual area and we can perceive depth and distance more accurately than with one eye.

Accommodation : Accommodation in perceptual process refers to the change of the eye lens in its curvature. This function is needed to focus different objects on the retina area. If the object is quite close, the lens becomes round and if the object is farther away the lens becomes flat. Kinesthetic sensations that effect these changes also provide some informations regarding the position of the object.

Retinal disparity: Our two eyes receive slightly different views of things. The difference between the images of the two eyes is called retinal disparity. The right eye could collect more informations from the right side and the left eye from left side and we could see that these two informations are different to some extent. Hold your pointing finger three inches away against your nose. Close your left eye and see the finger with

your right eye and then close your right eye and see the finger with your left eye. Do it rapidly for several times. What do you see ? Your finger is moving fast from left to right and from right to left. In reality it is not moving. This is due to retinal disparity. But when you see the finger with your both eyes the two different images merge into one and you see the finger is not moving. This is stereoscopic vision, makes the depth perception more accurate. Our two eyes may have overlapping perceptual fields or slightly different pictures. The binocular perception removes such differences.

Convergence: When we look at objects that are farther away from us the lines of our vision in both eyes are parallel. But if the objects are moved towards us at a close distance our eyes tend to converge. They turn slightly inward towards each other. The kinerthetic sensations control this movement. In this way our eyes provide additional informations.

Factors of Perception

We have stated in the preceding sections that perception is more than what the messages sent to the brain by our senses. Several factors effect perception and several factors are operating in perception. No two students of the same class perceive the subjects psychology in the same manner. The university tower is not perceived in the same way by a present student as by an old student. In perceiving physical objects there may be greater degree of unanimity. But, if the objects to be perceived are human beings we have troubles. In spite of it, if the background of experience and culture are not having too much difference, it is possible to obtain success in our perception. Children see the world differently from their parents. Women perceive world differently from men in several ways. Therefore, there are several factors or conditions that determine our perceptual process. These factors sometimes facilitate our perception and make it accurate, but sometimes make it inaccurate and lead to false perception. They are mainly motivation, expectations, cognitive style and culture.

Motivation : Perceptual process is highly influenced by the individual's desires and needs. When the individual is in need

of something he will perceive the same which, according to him, satisfies his needs. Experiments have been conducted to determine the influence of physiological need on perception. When a person is feeling hungry, an ambiguous figure is perceived by him as related to food. McClelland and Atkinson conducted an experiment to study the motivational process. Persons who had not eaten food for several hours were made to see blurred pictures. They starved for varying hours ranging from one hour to 16 hours. Persons who starved for 16 hours saw images of food in the picture more often than the persons who starved for less number of hours. The physiological drive for food made some persons to perceive images of food in the picture. In our every day life there may be several instances in which motivation may be playing important role in perception.

Expectations : Our perception is greatly affected by our advance knowledge—the expectations. How the individuals respond to certain words have been tested by Siipola. In this study the experimenter told a group of people that they would be presented with words related to animals. But instead of words related to animals some combination of letters that did not give any meaning were shown. The combination of letters, Wharl was perceived as Whale, dack as duck and sael as seal. The second group was told that they would be shown some words referring to boats and the same letter combinations were shown to them. They perceived the same as wharf, deck and sail. Because they have been guided to expect something related to boats they perceived words related to boats even in nonsense syllables. In our daily life we may be expecting several things and we try to see them as we want to see them.

Cognitive style : An individual as he grows develops a cognitive style of his own in dealing with the environment. The person perceives the environment as a whole and does not see clearly the shape, colour, size and the qualities of individual items in the environment. He sees everything combining with the environment and not isolating from environment. These people are called field-dependents. But the field-independents on the other hand try to perceive elements separate from the environment and separate from each other.

Culture and Society : The culture in which one is born and adapts is having influence upon his perception. For example, the language one speaks may determine as to how he should perceive his environment. The individual may use various kinds of perceptual cues. All these are based upon his culture.

Our perceptual process may receive suggestions from outside in the form of action or words indirectly. We accept what others do in our society. The society in which we live determine many of our perceptions. Sherif, an American Psychologist has conducted an experiment to measure social effects on perception. It was a dark room experiment to study the individual's autokinetic response. A point of light was fixed on the wall, and the individuals were asked to watch. Suggestion was given to them that the point of light is moving in small steps and every one is asked to measure in inches the distance the point of light moved. Then all the subjects were put together to measure the distance the light moved. The judgment of the persons varied. This shows that the individuals modified their perceptions on the basis of the suggestion received from others or in confirmity with others opinions. This is how parents or society transmit to the children the cultural values and standards. Similarly the old members of the society transmit the cultural value to the new members of the society and these values determine their perceptual process.

Errors in perception

Our perception sometimes fail to correspond with the actual stimulus. Error in perception may be defined as the disturbed or mistaken perception that does not agree with object measurement and is brought about by conflicting sensory cues.

Illusions : Human perception is not always accurate and perfect. Sometimes perception becomes easy and correct and sometimes difficult and erroneous. When the stimulus is ambiguous and sensory apparatus is not accurate we have false perception. The sensory apparatus fails to identify the object perfectly. This kind of false perception is called illusion.

Woodworth, the American Psychologist observes that an illusion is an error of perception. If perception is for measure-

ment, the observer judges the object with all his discriminatory power and if the judgment is not totally accurate something in the object is misleading him. This we call visual illusion. If perception is for identifying certain object, the observer observes, identifies and names it. Sometimes he does it correctly and sometimes fails to do it. When he fails to identify and name it correctly we call the process illusion. This kind of illusory perception may be due to several factors like the characteristic of similarity in the objects, the observer's certain past experience, environmental condition and sensory apparatus. For example, a white shell is mistaken for a silver coin, a rope is mistaken for a snake. The shell and silver coin have certain similarities. The rope and snake have certain similarities. The observer perceives the shell and rope with his past experience with silver coin and snake. Further, the place may not be a bright area as to see objects clearly and his vision may not be very acute.

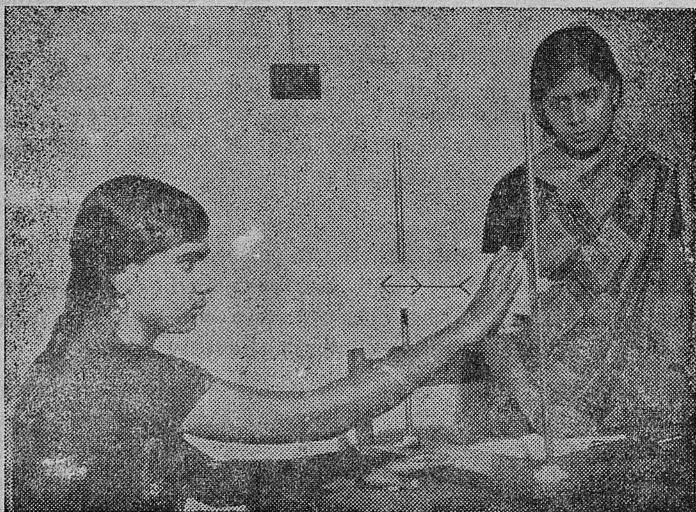


Fig. 6.4 Optical Illusion (Muller-Lyer illusion board test).

According to Kendler an illusion is a representation of a discrepancy between physical and psychological measurement.

It is also stated as a false representation of the qualities of the stimuli presented for perception and what is perceived, is not exactly related to the stimulus.

The most widely known illusion is the Muller-Lyer illusion. In the Muller-Lyer illusion, there are two horizontal lines, one consists of feather heads and the other arrow heads. They are of equivalent length. But human beings perceive the feather head line to be of greater length. The slanting position and the size of the arrows contribute to the illusion.

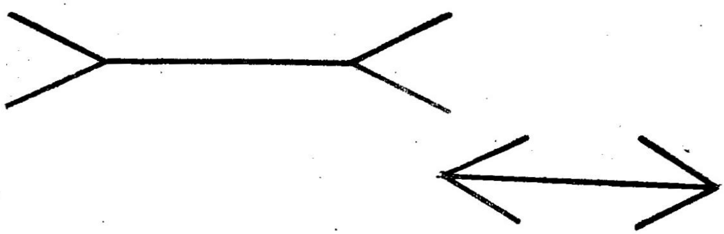


Fig. 6-5 Two lines in the Muller-Lyer illusion.

Another important illusion is the moon illusion. The moon appears much larger near horizon than it looks at the sky. The moon illusion is due to the angle of the vision at which we perceive the moon.

There is another illusion, called Penzo illusion. This is similar to Muller-Lyer illusion. In Penzo illusion two horizontal

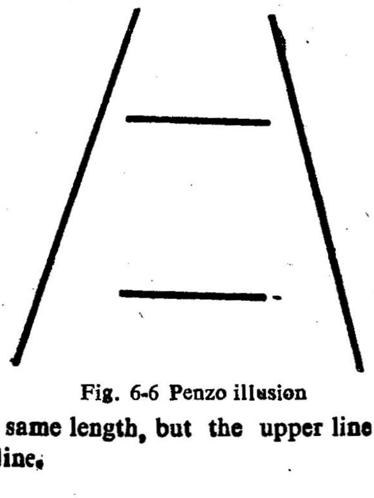


Fig. 6-6 Penzo illusion

lines are of the same length, but the upper line appears longer than the lower line.

There are also illusions of movement shape, and size. We sometimes perceive movements in objects when physical movements do not occur. On the motion picture screen we see only still photographs. But we see movements of persons and objects in a continuous manner. A series of discrete still pictures are presented with so short intervals that we combine them in our perceptual process and see the figures as moving. This movement is only apparent and not real. Therefore the movement is an illusion. This apparent movement is named as the phi-phenomenon by the German Psychologist Max Wertheimer, the founder of the Gestalt School of Psychology.

According to Woodworth there are two kinds of causes of illusion, one is due to retinal physical cues and the other is within the organism. The physical cues sometimes mislead us. For example, the light and sound may misguide our senses. The mirror misguides us and creates illusion. In the mirror drawing apparatus the subject drives the stylus along the pattern by seeing through the mirror and commits lot of errors. It takes sometimes for him to overcome the mislead given by the mirror. Even the mirror in which you see your face several times every day misleads you. By constant use of the mirror you learn to overcome the illusions.

Illusions are also caused due to familiarity of certain objects. For example, we have developed a habit to read every printed material rightly. If there is a printing error in a word we overlook the error because of the familiarity with the words. For example, we read the words muoth as mouth and shrit as shirt, ignoring the printing errors in these words.

The set you made already to perceive something would cause illusions in certain situations. You set yourself to perceive a particular object. Another object which may be having certain resemblance with the object you want to see is often mistaken. For example, in a desert a man sets up himself to see water because he is feeling thirsty. At a distance the mirage appears like water and he is disappointed when he goes nearby.

Hallucination: The problem of illusion and hallucination is in this way are interactions of the inner and outer determinants

of perception. A real perception is one that agrees with the physical stimulus. A false perception is one that is determined by the individual's memory. It is also mistaken one thing for another. But hallucination is a form of perception in which a person sees and hears something but in reality there is nothing and no one perceives the same thing around him. This is an abnormal symptom. The person hears voices and sees visions. This is an abnormal hallucinatory experience. This differs from common hallucinatory experience. People are having this experience in their every day life. But it varies in degrees. A hallucination may be defined as a sensory experience in the absence of the corresponding external stimulus. It is a misinterpretation memory or imaginary experience at true perception.

Sometimes we may feel that something is running across our skin but actually there is nothing. We may respond to some voice, but nobody calls us. These are all some kind of peculiar misperceptions and do not represent objective reality. Therefore, illusions and hallucinations are certain physiological and psychological states of organism.

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CHAPTER VII

INTELLIGENCE AND ITS MEASUREMENTS

Introduction

There is no other concept in the field of Psychology that is better known to the public or common man than the concept intelligence. A person, whether he knows the meaning of the concept or not never fails to appreciate another person or himself by using the word intelligence on finding some excellence in another person or on himself. We admire intelligence in others and we may describe the whole man with this. Man manifests himself in a variety of ways. There is no person in this world exactly like yourself nor he would be born. Therefore what distinguishes one person from others is the way in which he behaves in different situations and also the way in w ch he organizes his motivational, perceptual and learning processes. The more an individual learns the more unique pattern of capacities he develops. The increased capacities to learn is the result of increased tendency to adjustment.

It is true that a man can learn a great deal of certain kinds of materials than the rat can learn. But some persons learn things very quickly while others learn the same thing very slowly and few others nothing at all. Some people can apply their knowledge more successfully while others do not This kind of individual differences in learning, application of knoweldge and reacting to situations are great concened of modern psychology. Intelligence is the concept attributed to describe all these phenomena.

What is intelligence ?

Intelligence is defined in several ways. It is referred to varieties of skill. Some say it is inherited and others say it is learned capacity through education. Still others say it is a combination of both. In whatever manner it is defined

intelligence is a characteristic of behaviours. This characteristic can be separated and measured. Wickens and Meyer define intelligence as the degree of proficiency with which the individual solves problems, deals with abstract materials, verbalizes and learns new material. It is also stated that intelligence is an overall ability which includes skill as perceiving relationships dealing with abstract materials, verbal facility and learning and retaining concepts.

Moskoweitz states that intelligence refers to an individual's ability to perform certain kinds of complex tasks.

According to Binet intelligence is a general capacity for comprehension and reasoning that manifests itself in various ways. Stagner and Karwoski are of the view that intelligence is not a physical object. It must be understood as a complex characteristic of human performance. It has two dimensions, speed and power. That is, how fast the person solves the problems and how difficult the problems are when he fails to solve them.

Psychologists offer various difinitions of intelligence. These definitions generally are focussed in different kinds of perfor-mance such as learning ability, ability to manipulate abstract symbols, ability to use learning in new situation and ability to solve problems, etc. Learning is a function that we find both in animals and human beings. But there is enormous amount of difference in speed and complexity of learning. At lower extreme we have feeble minded cases who are not developed to learn the acts of normal human beings. At the other extreme we have persons who deal with extremely complex abstract functions. Gardner Murphy says that intelligence means the ability to learn and the ability to learn increases steadily with the complexity of the nervous system. He states that the ability to profit from experience and environment is called intelligence. His definition of intelligence is from biological point of view.

The evolution of the brain has led to human behaviours which are superior to those exhibited by other forms of life on the earth. These behaviours are commonly referred to reflecting intelligence and therefore being intelligent behaviours.

Spikes and McCandless say that intelligence is what the intelligence tests measure. It is known as operational definition. Because the psychologist measures what he calls intelligence with his tools. As there are many kinds of tests of intelligence there may be different words of intelligence. Each test measures one intelligence. Therefore we must specify the particula intelligence we speak about at the time of measuring. The oper rational definition is not satisfactory one for some.

From the sensory field, intelligence refers to some fixed structural or genetic potential for learning. The structural potentials are not measurable. The only thing that we can measure is, an organism's current behaviour. In this sense an intelligence can be interpreted as an index of potential earning ability.

Most of the definitions and descriptions of intelligence have academic basis. In every culture there is a tendency to evaluate people's intelligence from the academic activities. The academic activities and achievements provide us with substantial data to show what an individual is capable of. We can see that only those people who can withstand physical and mental strain could make progress not only in academic life but also in every walk of life. How are we to describe this behaviour phenomena ? Naturally, they are intelligent people. They plan, work and achieve. They are also responsible and dutiful. Otherwise they could not make any achievements in life. The higher form of intelligence, particularly creativity is determined only from the achievements one had made.

We have stated earlier that intelligence is sometimes referred to learning ability. But some are of the view that learning ability is not fixed nor a unitary organismic variable. Therefore learning may be referred to the ability the person possesses at the time of performing a particular kind of task. After sometime learning ability may change and there may be a time in a man's life that he may not be having equal abilities in all walks of life. A man's successful performance may also depend upon his motivation. A person who is very brilliant in language abilities and games may be lacking in mechanical abilities and his acquired

abilities in various areas may change when he advances in age. This may also change his motivation and interest. Therefore learning ability is subjected to change. If intelligence is referred to learning abilities intelligence also is changing with age. Therefore intelligence cannot be called as a unitary and wholesome characteristics of an individual and he would solve all the problems at all times. These characteristics of intelligence made Spearman to think of a general intelligence (abilities) and special abilities.

Charles Spearman, a famous British Psychologist after working on intelligence for 20 years suggested that intelligence is more than an accumulation of specific skills. In 1904, he described the general intelligence which he called the 'g' factor as a kind of mental energy that flow into everything the individual does. The individual who is endowed with this intelligence behaves intelligently in varieties of situations. He also found that some people with this intelligence do not act well in certain areas. Some are quick and successful while some are not. It is a branch of 'g' factor in other activities in different degrees. When the general intelligence manifests in specific activities it is called 'S' factor.

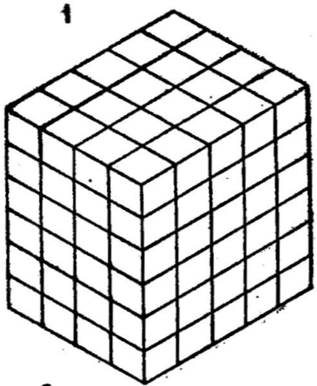
But, the American Psychologist Thurstone described intelligence in different manner. He called intelligence as the primary mental abilities. It consists of several abilities. According to him there are seven abilities such aa (1) Spatial ability (2) Perceptual speed, (3) Numerical ability, (4) Verbal meaning, (5) Memory, (6) Word fluency and (7) Reasoning. Thurstone observed that these abilities are independent of each other. This means, a person who is high in perceptual speed may be low in word fluency. One or more abilities may be found in an intellectual activity.

Another American Psychologist, Guilford felt that both Spearman and Thurstone have not desoribed intelligence perfectly. He stated that there are three kinds of mental abilities. They are (1) Operations (2) Contents and (3) Products. The operations refer to the act of thinking, the contents to the terms through which we think such as words

and symbols and the products refer to the ideas with which we arrive at. He stated his theory as three dimensional model. Within each category there are several factors included.

1

2



3

Figure 7·1

Guilford's three dimensional model of structure of the intellect.
1. Operation, 2. Contents, 3. Products.

On the basis of these informations we may state that there is some kind of general intelligence and also special abilities depending upon the structure, development and knowledge of the individual.

Measurement of Intelligence

Intelligence is what an intelligence test measures. This is one of the definitions we have discussed earlier. Here measurement appears to be the primary matter. The interest to measure intelligence was aroused by the evolutionary biology of nineteenth century. It tried to explain the causes of individual differences. Darwin's theory, the survival of the fittest stimulated the psychologists to measure the ability of men to learn. Francis Galton as early as 1880 started an anthropometric laboratory in England. At the same time Cattell also shown greater interest in the measurement of simple abilities like sensory activity, reaction time, memory, motor skills aud head size on the idea that these are the components of intelligence. He has combined physical strength

in measurement of intelligence. But the method and the result of his study did not attract many men in this field.

When the school authorities in the city of Paris were worried over the backwardness of the school children in the class room and wanted to find out the causes of it, Alfred Binet, a French Psychologist came forward to study the problem. He was already interested in the matter of intellectual development and wanted to find out some method to measure intelligence. His assumption was that the dull child was like a normal child but backward in the mental development and he would perform on the test like a normal child but like the younger child. He had the idea that children do better in their performance as they grow older. Therefore he devised tests for different age level from 3rd year to 7th year with increasing difficulty. In 1905 Binet-Simon test appeared with 30 items. It was in a crude form.

They published a revision of the test in better form in 1908 and 1911 extending the test upto the adult level. Binet has also devised a scale of scoring concept called mental age. When the test was found to be useful in measuring intelligence immediately it got the attention of the American Psychologists. In the year 1916 Terman brought up a revision of Binet-Simon test for administering upon the American children. This has become a model test for many intelligence tests. It is called Stanford-Binet Intelligence Test. This test underwent two revisions again in 1937 and in 1960.

Mental Age : The important characteristics of Stanford-Binet test is the concept of mental age. The test consists of series of sub-tests arranged according to age level. Upto 5 years there were two sub-tests for each year and from 6th year to 14th year one sub-test for each year. The experimenter while administering test, starts with each child with easiest item at the top of the test and works out till the child answers no more questions. After collecting the data from large number of children he could see a pattern. That is, in each age group large number of children were able to answer all most at the same level (the same number of questions)

while a small number of children stopped at the bottom of that level and some children went beyond that level. The average scores of the normal is determined.

If a 4 year old child answered all the items of a 4 year test his mental age would be 4. The same child if he answered all the items of the 5th year test his mental age would be 5. If he passed all the items at 8 and half of the items at 9 and none of the items at 10 his mental age would be 8½. His over all performance is equalled the performance of an average 8½ year old child. The mental age is obtained from the scores and the chronological age is the individual's actual age.

A child, whose chronological age is 8, has a mental age of 8 if he can do the test of an average 8 years old child can do. But if he would do the task of an average 7 year old child his mental age would be only 7. He is supposed to be a dull child. If a child's performances were better than the average of his age he is superior in intelligence.

The concept of an intelligence quotient (I.Q) : The intelligence quotient speaks of relative intelligence. The I.Q. is a comparision of a person's performance on a test to the performance of other persons of the same age. It may change due to time. Mental age increases at the same rate as the chronological age in normal children. But the M.A. of a bright child, who is far above the average increases faster than his own chronological age and the chronological age of a normal child. But the M. A. of a dull child, who is below average, increases slower than his chronological age. For example, two children have the same mental age of 9, one is 6 year old and the other 9 year old. This means that the 6 year old child is brighter than the 9 year old child. The brightness of the children can be expressed quantitatively. At this stage only we came across the intelligence quotient (I.Q.).

The I.Q. is expressed in the form of a ratio between mental age and chronological age. In order to avoid the decimals he ratio is multiplied by 100. Therefore the formula is :

$$\text{I. Q.} = \frac{\text{Mental Age (M.A.)}}{\text{Chronological Age (C.A.)}} \times 100$$

We have stated above that two children of different ages. 6 and 9 have the same mental age of 9. Let us apply the formula on their M. A. and C.A. to determine their I.Q.

The I.Q. of the first child is $= \frac{9}{6} \times 100 = 150$

The I. Q. of the second child is $= \frac{9}{9} \times 100 = 100$

Let us assume that a 10 year old child also has the same mental age of 9.

The I Q. of 10 year child is $= \frac{9}{10} \times 100 = 90$

The child of 6 year old with a mental age of 9 has an I. Q. of 150 and the child of 9 year old with an M.A. of 9 has an I Q. of 100 and the child of 10 year old with an M. A. of 9 has an I. Q. of 90. The first child is extremely bright, the second child is average and the third child is below average or he is mentally retarded. The I. Q. indicates the rate of intellectual growth of the children. If a child performed the tests and obtained an M. A. to the level his C. A. he is an average child. Woodworth points out that the mental age is the measurement of the level intellectual achievements whereas the I. Q. is an index of brightness.

Examples of some of the items in Stanford-Binet test

Age	Type of item	Description
4	Naming objects from memory	Toy, automobile, dog, shoe etc. These are presented and named. Then one is covered and he is asked to name it from memory.
	Picture identification	Cards with pictures of objects were presented. Child is asked to 'show me what we cook on' 'what do we carry when it is raining' etc.,
7	Similarities	In what way wood and coal alike ?
	Copying a diamond	Ship and automobile ? etc., Draw three diamonds (Printed in the record booklet).

Construction and Standardization of tests : Intelligence tests must provide scores that are convertible into mental age and I.Q. In constructing such a test care must be taken in the selection of test items. First of all it must be assumed that intelligence increases with chronological age from birth to maturity in a continuous process. The first step in test construction is, the selection of items that will reveal the intellectual abilities of the individual. The items of the test must cover various areas like perception, discrimination, learning, memory, manipulation of numbers. vocabulary, reasoning and other elements of human abilities.

In the second step the population is selected. It must be from very wider range covering different geographical age, sex, different socio-economic status and rural-urban areas. This population is used as a standard. The purpose of selecting this kind of wider range of population is to get a normal or average score for each age group with which the individual score is compared. The normal or average score is the middle range of the distribution of the scores of the whole population. The items devised for each age group (for example, 4th year, 5th year... 14th year) are administered on a large number of children. The percentage of the children who pass each item of each age level is determined.

At the final step, the earliest age at which each item is passed by 50 to 75 percent of the children is determined. Therefore every test is given to a large sample of children for whom it is developed. The average score, the range of distribution of scores also are determined for various age groups. Unless the test is standardized in this fashion an intelligence test is of no use. Test developed in this manner lead to the concept of mental age.

Verbal and Performance Tests

Intelligence tests are designed to measure the general intelligence or certain special abilites of human beings. These tests are administered to individuals and to a group of people. They are respectively called individual tests and group tests. Individul tests are administered to one person at a time. The

Standford-Binet test is a good example for this. The group tests are administered to a large group of people simultaneously.

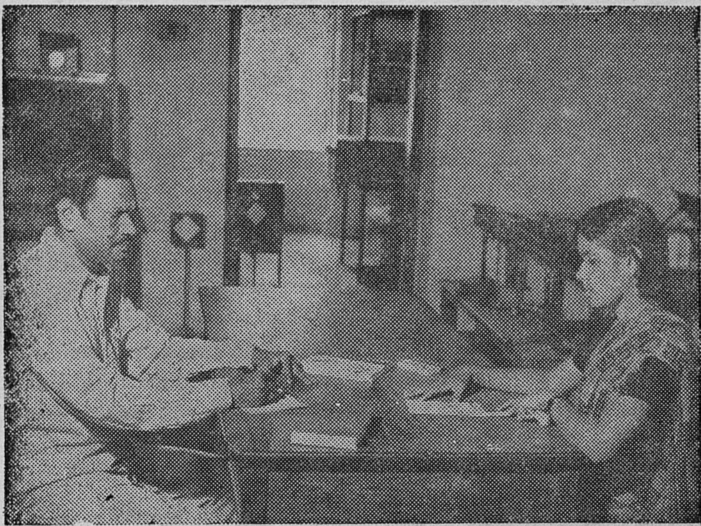


Fig. 7.2 Stanford-Binet Intelligence Test.

The Army General Classification Test (AGCT) is a group test. Intelligence tests are further classified as verbal tests and performance (non-verbal) tests.

Verbal Tests : The verbal tests require the skills in using language. The verbal tests are designed to measure the general intelligence or some special abilities. These are contrasted with performance tests. The verbal tests are also called paper-pencil tests, because most of the tests are written language in giving instructions to the examinee and also in the questions to be answered by him. The verbal tests are used to test the ability to deal with ideas by the use of words. One of the important verbal tests is the Thorndike CAVD test. It has four sub-tests such as Comprehension (C), Arithmatic (A), Vocabulary (V) and following the Direction (D).

The items are carefully graded in all four areas. The items run from very easy to very difficult. The difficult items are so

hard that every one will have different level in scoring. Therefore nobody would answer all the items. Because of these characteristics the test mainly measures the individual differences in intelligence. It can differentiate those who are superior in an activity. The test puts at the top those who are really very bright. In judging the intelligence of the individual we must put all the tests together.

The Army General Classification Test (AGCT) is another important verbal test widely used during the world war II. This test brings out three primary functions of the individual. They are (1) Vocabulary (2) Arithmatic reasoning (3) Block counting. In block counting the examinee is shown with piled up blocks. He has to find out and tell how many blocks were in sight and not how many are behind out of sight. This test is not suitable to College situation. Therefore the American Council on Education test (ACE) is used in College situation as the most representative test. It emphasises the necssary skills dealing with words and mathematics.



Fig. 7.3. Wechsler Adult Intelligence Test—Picture Completion test.

It is felt in recent years that the adults who are to be recruited to various jobs must be tested with intelligence tests.

The Stanford-Binet test was found to be inadequate for adults The need has been fulfilled when David Wechsler, a psychologist designed and developed specifically for use with the adults. Originally the test was published in 1939, but it was revised and published in 1955 as the Wechsler Adult. Intelligence Scale (WAIS) The items of the test are arranged as sub-tests and there is no age levels in it.

The WAIS consists of eleven sub-tests, six of them are verbal tests and five of them are performance tests. The verbal tests are (1) Information (2) Comprehension (3) Arithmatic (4) Similarities (5) Digit Span (6) Vocabulary. The five performance tests are (1) Digit Symbol (2) Picture completion (3) Block Design (4) Picture Arrangement (5) Object Assembly. Wechsler has developed two more tests. one for children (WISC) and one for Pre-school and Primary school (WPPSI).

Wechsler scaels yield three kinds of I.Qs He believes that the verbal scores should be supplemented by performance scores. The three I.Qs are verbal, performance and verbal and performance.

Performance and Non-verbal Tests : The performance tests were developed for those who could not take up verbal tests. These tests do not involve words. Culturally deprived group, children of foreign speaking parents, unschooled persons and those who do not fit for verbal test would take up performance tests. For these reasons a number of intelligence tests have been developed to reduce the dependency on verbal skills. These tests are called performance or non-verbal tests.

The most widely used performance test of intelligence is the Draw-A-Man Test. The test was developed by Good-enough and revised by Haries in 1963. The idea behind this kind of test is that the ability to draw human figure in correct proportion with all the details goes with age and intelligence. We can administer this test upon children upto the age of 15. It is easy to administer and also interesting. It correlates well with other tests.

A second important performance test is the Arther Adaptation of the Leiter International Performance Scale. It is a very interesting test. It can be administered on children aged from 3 to 8 years. There are block and they are randomly presented to the children. They are asked to match the blocks with stimuli which are visually presented in on cards. The child is expected to exhibit the ability to grasp the sequential principle in the stimulus cards. Since the test direction is through pantomime or signal, words are not used of any stage. Words are not used even to express the correct responses. Therefore it is almost a non-verbal test correlates highly with Binet test. This test is highly valuable in testing deaf children and those who have language difficulty.

A widely used performance test is the Pintner-Patterson Performance Scale. This test reveals the general performance ability of the child. The Healy Picture Completion Test is a performance test which can measure the child's complex intellectual functions without any verbal questions. The child in this test is required to put the blocks in the appropriate holes in the picture. In this task he has to grasp the idea to fit the block into two holes and something more than that - that is understanding the physical and social situations for the child. The Healy Picture Completion Test is very much useful in clinical situations and in dealing with children problems.

The Cornell-Coxe Performance Ability Scale was developed by two authors in 1934. It is individually administered. The test includes diverse tasks such as the arrangement of form boards, completion of missing parts, assembling of discrete parts into wholes. The amount of time taken by the subject to complete the test and the number of errors made by him were taken as the scores.

There were also other very effective individual performance tests, developed for the measurement of intelligence of the child. Among the most widely used individual test is the Kohs Block Test and the Portesus Maze Test. The Kohs Block Test is included in the more extensive performance test batteries. In

the Kohs Block test, the subject is required to match a series of designs with blocks of different colours. The procedure is starting with the simplest designs and going through the most complex designs.The simplest designs require a minimum number of four blocks, and the most complex design require upto sixteen blocks.

The Porteus Maze Test is a Maze test. It consists of a series of pictures of mazes and the subject is required to trace each maze. The mazes become progressively more difficult. Each is to be solved correctly. The test may be administered on a population ranging from three years of age to the adult level. There is no time limit for the test. The subject's mental



Fig. 7·4 Alexander's Pass along Test.

age is determined by the relative difficulty of the last maze the subject is able to trace correctly.

There are also several other performance tests such as the Alexander Pass-along Test, Cube Construction Test, Block

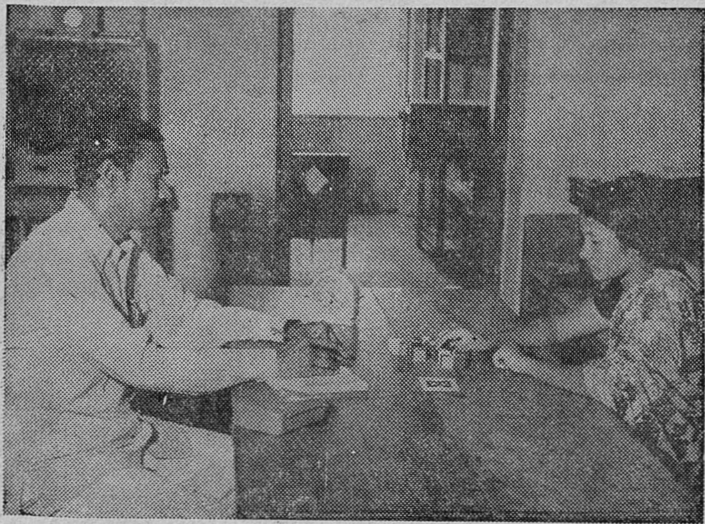


Fig. 7·5 Cube Construction Test.

Design Test, Form Board Test and Matrices Test etc.

Group Tests

We have been so far discussing the individual tests. Most of the tests can be administered on a single person. The administration, scoring and interpretation should be made only by trained examiners. Therefore these tests are very expensive and time cousuming. But the group intelligence tests can be administered to a large group of individuals at one time. During World War I thousands of men had to be tested for their fitness for military service. Therefore there was an urgent necessity to develop group test of intelligence. A committee of Psychologists were appointed to devise the group tests. The committee has developed two group intelligence tests called the Army Alpha Test and the Army Beta Test. The Army Alpha Test was a verbal test devised for those who could read and write English language. The Army Beta Test was designed as a performance and non-verbal group test for

these who had language difficulty and for those who were unschooled.

During the World War II, the American Psychologists have developed the Army General Classfication Test for testing large number of individuals. This was found to be better than the Army Alpha Test. This test was useful to drop out men who were severely retarded from military service and also to fit men who were required to modern war fare.

Following the Army test several group tests have been developed to meet various needs of educational and industrial and counselling purposes. One such test is the Otis-Lennon Mental Ability Test. This test consists of different forms for elementary school, junior high school and senior high school students.

A group intelligence test advanced for college students is the Scholastic Aptitude Test. This is a very reliable and well standardized test, used to select students for admission to Universities. The test would predict whether a student is likely to succeed in college level work or not.

Examples of some of the items of group intelligence test

In the space provided on the left write the number of the words that is different from the other words

1. Apple 2. Orange 3. Cup 4. Banana 5. Peach

* * * * *

In the blanks below write two words opposite in meaning to cold. One should begin with 'h'; the other should begin with 'W'

h ———— —

w ————

* * * * *

The numbers in this row follow one another according to some rule. You are to find the rule and fill in the blank to fit the rule.

2 4 8 ——— 32 64 ———

* * * * *

If the following argument is good reasoning, mark it plus (+). If the argument is faulty reasoning, mark it minus (—) on the line left.

_All people who vote are twenty one year old.

John Smith did not vote.

Therefore, John Smith is not twenty one year old.

* * * * *

Group tests have certain advantages of saving time and money. But there are also certain disadvantages. They are not as meaningfully measuring the intelligence as the individual tests. In the group test situation the examiner may not be having control over the examinee. A person may fail to understand the correct meaning of the instruction given to him or may not be motivated to take up the test in right sense or he may be in a depressed state or fatigued. These conditions may have effect upon his performance. Group tests often yield low scores and so persons are classified as being of low intelligence.

Uses of Intelligence Tests

One of the most useful tools available for a teacher, counsellor, educationalist, business and industrial organizations is the intelligence test. People who are engaged in grading the pupil, counselling the clients, recruiting persons to various jobs should have some knowledge in the administration of intelligence tests. and in the interpretation of the scores obtained from the tests. There is no trade secret in this. The key is there for their use.

Individul diagnosis and guidance : Intelligence test serves as an aid in diagnosing pupil's difficulties and problems. A good teacher is interested in finding out whether the particular pupil is working to his potentialities. If it is not, what is the real cause behind his low achievement. He requires some help. To determine his actual scholastic aptitude an intelligence test must be administered on him. The scores would reveal where he stands in comparision with other pupil. Then he may find out the fact whether the low achievement is due to lack of capacity or something else.

One of the important purposes for which intelligence test may be used is the educational and vocational guidance. The

pupil may require guidance in various areas. The knowledge of the scholastic aptitude test is very much useful in helping the pupil to select the proper course of study at high school and college levels. Guidance can be also provided to the pupils whether they can proceed further on their studies at college or take up a vocation after the completion of the high school studies. If the decision is to take up a vocation what type of vocation he should choose also may be determined.

Further if the school teacher knows the intelligence scores of a group of children at the beginning of the school year he may use the data along with other informations in grading, guiding the pupil, assigning the level of texts and other learning materials and he can set the goals and expectations of the students. The curriculam planning and grouping also can be done on the basis of the I.Qs. of the students. Intelligence tests may measure apparently what the teacher wants. The test scores may be useful for him in predicting certain traits. For example, verbal competence is related to achievements in academic subjects. If the teacher knows it in advancs he can provide certain opportunities for the pupil to develop the verbal skill if they are lacking it.

Placement and Programming : Ever since the development of the intelligence tests one of the important uses of them has been the determination of placement of the students in schools and colleges. Which student should be admitted to regular school study and which student should be placed in special courses ? In the United States many schools and colleges have their own standard of I.Qs. and mental ages levels as a limit for admission to their institutions. Intelligence test in this respect is of great help to the educational institutions in admitting students in various courses.

Colleges and Universities may find difficult time with their programmes to execute if some of the students, in every course of study fall below the average level. These institutions may go ahead with their programmes successfully if admissions are done on the basis of the scores of certain intelligence tests.

Intelligence tests may be used for diagonistic purposes. We can find out the individual's strengths and weaknesses not only. in the academic activities but also in the over all performances

Further, intelligence test may be used to measure individual's present abilities. People may have different opportunities in learning and developing their skills. The measurement of these skill may be of immense help to certain organizations who are selecting men to various trades and occupations. Selecting men to various jobs and placing them at different levels may be done successfully on the basis of the scores of intelligence tests. The disadvantaged persons may be traced out and proper care may be given to them to develop their skills. The student unrest in the Indian Universities may be reduced to some extent if the college and University authorities would encourage Psychological testing programmes in their institutions.

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CHAPTER- VIII

CREATIVITY AND ITS MEASUREMENT

Introduction

After the World war II there has been an increasing tendency among the developed nations to compete with each other in the scientific, artistic and technological inventions and discoveries. The real competition has been the utility of intellectual resources in various areas successfully. Therefore individual's intellectual abilities and talents were encouraged to the maximum possible extent, so that they may be useful to themselves and to the nation. It is an accepted fact that we need more brains to survive in the competitive societies or nations. Therefore it is important to identify many kinds of talents by means of psychological tests.

Psychologists for many years have been engaged in this task of identifying talents of school children by using intelligence tests. But the conventional intelligence tests were not sufficient to exhibit certain special talents in human beings. At present there is a great need for mathematicians, scientists and linguists all over the world. Eventhough these abilities are included in the intelligence tests probably these professions require little different abilities. If the psychologists search for these kinds of talents they should not search them with their existing intelligence tests. Therefore, it is a challenging task for the psychologists to develop tests that would identify the special talents of creative type. Who are the potential creators? Who can make something an original in artistic scientific worlds ? Persons who are making extraordinary achievements are called genius. Therefore, the concept creativity is always associated with genius or creator or inventor.

What is creativity ?

Many artistic, scientific and technological achievements have been made in modern times. Whether it is a develop-

ment of a theory of relativity, creation of a new music, invention of a new type railway engine, or an artistic painting or sculpture all have the same psychological process. Creations are made by individuals who have put themselves in the field for work. They make achievements only after very long time of vigorous work. They might have made lot of unsuccessful attempts and received ineffective responses. Several times they might have failed to achieve a correct response to solve a problem. Therefore it implies that correct response is not available at once. Several trial-several errors might have been the incidents in an invention or creation.

In this task of creation the individual himself requirer to judge his own skill whether he can make any creation os invention. The artist must judge whether a particular colour could impart something new in the whole product. Similarly a scientist may be making some judgement about his exploring activity with an evpectation of getting some promising result in the particular direction.

Creation and invention are most complex activities which require much greater degree of schematic and sustained activities and critical abilities. Therefore creativity may be defined as the capacity to discover something new, a mixture of realistic and imaginative thinking often resulting in normal solutions. Gardner Murphy says: It is a capacity to produce through thought and imagination; capacity for original work. According to him there are two kinds of mental activities, that which reconstructs the past and that which initiates the new.

How do we judge things? What prompts men to make something which appears beautiful to him and to others? The answer is the every day impulse and not intuition. There is an impulse in man to search for something new in art and science. The impulse to invent or to create something new was present in the cave man as well in the modern man. The cave man was the first inventor or creator. Otherwise he would not have carved out the caves nor painted the walls with beautiful colours and written his thoughts. The impulse to invent or to create new is also based upon necessity. This is also an impulse or urge to discover something new.

We have used here three concepts such as discovery, invention and creation. These three concepts appear to be similar, but they are different. The concept discovery refers to finding out something from the existing things. The object or product is already there. The discoverer only finds out as to what it is and where it is. For example, Cook discovered Australia and Columbus discovered America. Australia and America were already there. Similarly in the case of invention, the inventor only finds out the product and explains what it is. The inventor is not finding out something out of nothing, but out of something. He puts the existing materials in different combinations and finds out the product. For example, James Watt invented steam engine and Graham Bell invented telephone. In all these things the basic materials for invention are already there. Therefore in discovery and invention there is nothing personal and effective. If Columbus did not discover America and James Watt did not invent steam engine someone else would have discovered and invented. In biological sciences there is only discovery and in physical sciences there is both discovery and invention.

But in creaiion the creator makes out something out of nothing. It is from his own thought, experience and imagination that he makes out something. For example, a play like Shakespeare's Hamlet or on epic like Milton's Paradise Lost, or the paintings of Leonardoda Vanci is a creation. The act of creation is the same in science as in art. It is a natural, human and living one.

How does a poem or a play differ from a theorem? Both are creations, brought out from nothing. The units in both differ because they match human experience in different ways. Every child can rediscover Pythagorean theorum in the same form. His experience is intellectual and can be matched exactly. In art this does not happen. Many people are painting women but not like Leonardoda Vanci. Many people write play but not like Shakespeare. It is impossible to match the experience of one person with that of another. Creativity is a multifaceted phenomenon. It involves developing something uniqne. Every one may become a creator under the stress of strong feeling. Therefore creativity is not limited to artists and inventors.

A child may devise a creative play. The clay is easily available for the child and he may create a new type of toy out of it. A house wife creates a new kind of taste in cooking to please her husband. Therefore creativity may be defined as the sense of ability to perceive something new in the external world through past experience and imagination and creation is the expression of such ability in some form so as to arouse the attention, curiosity, feeling and emotion of others in different degrees on the basis of their experience and knowlledge. The form of expression of creativity may be a poem, play, painting, sculpture or even a musical tone which was never in existence in the same form.

Creative Process

The creative person or the creator always tries to link the elements that are not in any way could link naturally. For example, a painter could create a species which may be a combination of both human and fish and he could call it a mermaid. It is a new combination not existing in reality. Creative process involves greater amount of imagination and thinking based upon learning and experience and continuous pressure-the pressure that J. S. Mill had during his adolescent period. Murphy says that the creative process involves sensitiveness to the environment and love of its colours, tones and relationships of space and time. All these enter into the trend of mind from which creativeness springs

The more sensitive a person is to the environments, forms, colours, tones, shapes, and contours the more he makes them as the roots of creativeness in his later life. It is the early joy in spatial and temporal relationships and mechanical laws that made Sir Isaac Newton to become great mathematician in his later life. Murphy observes that to become creative that the individual is sensitive and selective for certain kind of materials in two ways, first by the way of directing attention to them and the second by the way of enjoying and making new combination with them.

Mackinnon emphasises five important stages in the creative proccess. They are (1) a period of preparation posing a problem (2) a period of concentrated effort to solve the problem

(3) a period of withdrawal from the problem (4) a moment of insight (5) a period of verification, evaluation, elaboration and application of insight. The tendency to see a problem and constantly making enquiries about it are the processes with which creation starts.

The basis of creativeness is one's awareness to the situation. There is something lacking in it and therefore there is a problem. This is one of the specific characteristics of a creator. Therefore the creative person is too sensitive to the situation. The creative process is not a unitary process. It is a combination of several processes like cognitive, motivational and emotional processes. This combination of processes involve a group of psychological processes like perception, memory, imagination, appreciation thinking, planning and deciding. These processes may be present in everybody but varies in degree, probably in greater degree, in a creator.

Guilford considers that creativity is a form of intelligence. He has associated a number of special abilities with creative process. They are flexibility, originality and fluency with words associations and ideas. These are associated with divergent thinking. The divergent thinking is one of the five operations of his thinking aspect of his theory of intellects. The convergent thinking emphasises on a single solution whereas divergent thinking on a number of different solutions. Guilford says there are also other abilities and they are lying out side of divergent thinking.

Creativity and Intelligence

Psychologists often relate creativity and intelligence in their studies. But there are two kinds of view. Some are of the view that creativity is a form of intelligence and some are of the view that creativity is a special kind of ability distinct from general intelligence. The two concepts have attracted several psychologists and several studies have been made. But all these studies have failed to establish that creativity is independent of intelligence.

It would be quite relevant in this context to discuss one of the important studies made by Getzels and Jackson, The test was conducted by them in one of the private schools in Chicago, They have administered intelligence and creativity tests on a group of students. These students were from 5th grade to 12th grade. On the basis of this testing the students were divided into two groups, as those who scored high in the creativity test and those scored high in intelligence test. These two groups performed regularly in academic achievements.

The authors observed that these student groups varied in personality traits. Those who had high I. Qs. found to be conscientious, careful and self controlled. Their goals appeared to match with those of their teachers. Those who scored high in creativity test were playful, expressive and independent. But they worked harder than the children with high I. Qs. and they did not adjust well with their teachers.

Another interesting study in this field has been made by Wallach and Kogan in 1965 relating intelligence and creativity. The subjects were 5th grade students in one of the suburban schools. These authors felt that the conventional intelligence tests would not serve their purpose and so they developed tests consisted of game like activities to evaluate creativity. There was no time limit for this test. The students were divided into four groups on the basis of their scores in intelligence and creativity tests. The students who scored high on both the tests performed well in both free and controlled situations and well with child like and adult like behaviours. The high creative and the low I Qs. were frustrated in the school environment, but performed well in a free context. The low creative and high I.Qs. valued school achievement highly and worked very hard to excel other students. The fourth group, the low creative and low I. Qs. wanted to avoid the school work. They are involved in social activities or expressed regression. The study suggests that there is different modes of thinking in creativity and general intelligence. But in many diverse activities both can be found.

Measurement of creativity

Just like intelligence tests, there were tests, developed to measure the creative abilities by several authors. Authors who

made studies in this field assume that the nature of creative process is diversified. Some of them found that projective tests were not much useful in testing the creativity of the individuals. Therefore group tests, inspite of their limitations, were developed by several authors like Guilford, Torrance, Getzels and Jackson, Wallach and Kogan. Guilford included factors like word fluency, expressional fluency, association fluency, ideational fluency, semantic flexibility and originality in his test. But Thorndike viewed that Guildord's test did not measure the real creativity. There are not many creativity tests like the intelligence tests.

Creativity Tests: The measure of creativity has caused surprise to some as it is not quite similar to the measurement of intelligence. But creativity tests are developed as open-end type and it involves not asking for a correct solution for a problem. The question usually is how many solutions the subjects can do? Scores are based on the number of solutions and on original answers.

Another important creativity test is the Torrance Test of creativity thinking. The test consists of some pictures A picture at a time is shown to the subject and he is asked to put some questions on the basis of the nature of the picture such as the scene and consequences.

The Remote Association Test was devised by Medrick in 1962. It was devised to meet certain specific needs. The test consist of 30 items. They are in the form of sets and each set contains three words. The subject is asked to bring out a link among the three words by giving a fourth word. The time to be taken by the subject is 40 minutes. The number of right links is taken as the score. It is very widely used tests.

In the year 1965 Wallach and Kogan brought out a battery of creativity test. They have followed Mednick in defining creativity. This test is widely used by Dr. C. R. Paramesh in India in several of his research works.

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